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Facts and Figures About Nebraska Rivers

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Facts and Figures about Nebraska Rivers

by
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Water Survey Paper No. 73

PREFACE

To begin with, a bit of apology!

When planning began for the 1991 Nebraska Water Conference, too little time remained for preparation of a fully adequate "Facts and Figures about Nebraska's Rivers." Other illustrations would have been prepared and the accompanying text would have been more complete and coherent if I'd not been so hurried and harried, increasingly so as the date for this conference approached closer. The illustrations had to be in the drafting room while the text was being written, and the illustrations had to be numbered and assembled before this text was completed. For these reasons, a few illustrations are not referred to in the order of their identifying numbers.

Possibly, at a later date, the information presented here plus subsequently prepared illustrations and expanded text can be released as a Conservation and Survey Division publication. Among the illustrations I would like to include in such a report are a profile of the valley for each stream whose profile has already been prepared. Since all streams in Nebraska meander to some degree, they are longer than the valley they occupy. Therefore, comparison of each pair of profiles - stream and valley - will be an indication of the amount of meandering, and that amount will differ from one river to another, and possibly will differ along the same river from one segment of its length to another. Whether the valley profiles display the same irregularities shown by the river profiles will be of interest.

Topographic cross sections at intervals along stream valleys also might provide some significant insights. For example, where Interstate 80 enters the Platte Valley from the east, the south valley "wall" is barely detectable, whereas both upstream and downstream from the general vicinity of that reach the south valley side becomes progressively more prominent.

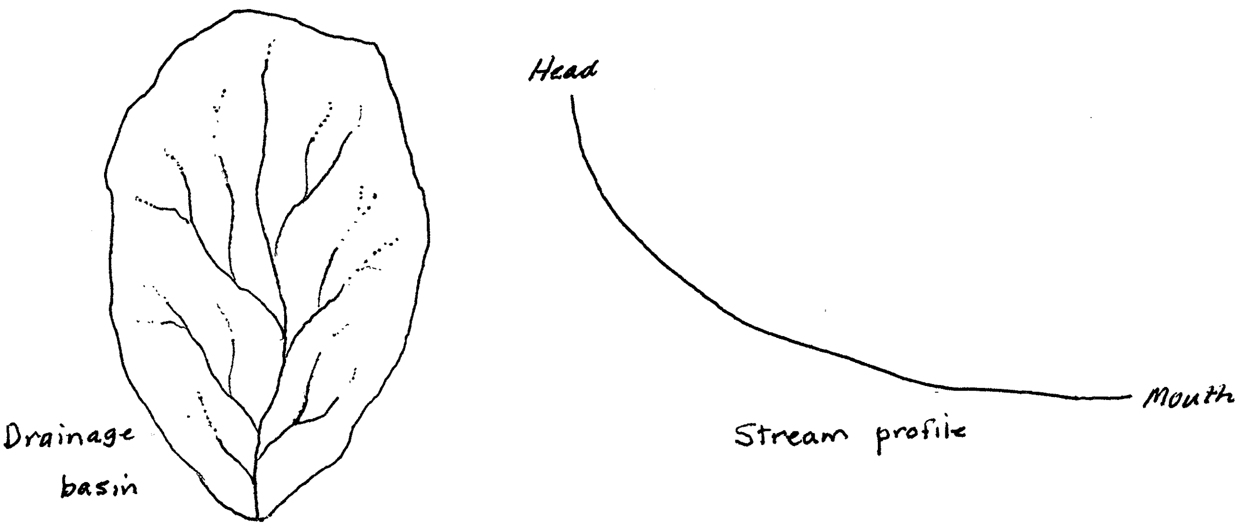
ACKNOWLEDGMENTS

Without the excellent help of the Conservation and Survey Division's cartographers - Dee Ebbeka, Jerry Leach, and Ann Mack - and of secretary Melba Stemm, this presentation could not have been completed in time for the conference. Even though working under pressure, they "came through" with flying colors.

RB
February 22, 1991

INTRODUCTION

A textbook illustration likely would illustrate a typical drainage pattern and a typical longitudinal profile as shown below:



The drainage pattern would resemble the veins of a leaf and the shape of the area drained would be nearly symmetrical. Too, the stream profile would indicate maximum steepness at its head, or upper end, and the gradient would decrease progressively in a downstream direction and be least steep at the lower end. Obvious on the map showing Nebraska's drainage network (Plate 1) is the assymmetry of the major drainage basins, that none of them resemble the idealized sketch.

Note in particular the following features of the state's drainage network:

1. The headwater ends of the Big Blue River and Lincoln Creek are very near the Platte River, (See also Plate 25, which indicates the position of the Platte with respect to the head of the Big Blue River and of Lincoln Creek.) Furthermore, all of the Big Blue's principal tributaries enter on the river's west side, and the topographic divide separating the Big Blue River and Salt Creek drainage basins is within a mile of the Big Blue River at one location (opposite the mouth of the West Fork).
2. Between Kearney and North Bend, the Platte River is close to the south margin of a broad troughlike valley that is shared by several other streams (among them the Loup River), all nearly parallel to the Platte for a long distance before they join it.
3. The topographic feature called Todd Valley (in Saunders County and drained by Wahoo Creek) probably was occupied by the Platte River at some time in the past but since has been abandoned.

4. Although the regional slope of Nebraska is eastward, the lower reaches of the North, Middle and South Loup rivers, also Cedar River and Beaver and Shell creeks flow southeastward.

5. Upstream from the town of Clearwater all of the Elkhorn River's tributaries enter from the southwest side, and the topographic divide separating the Elkhorn and Niobrara drainages is very near the Elkhorn River.

6. Downstream from the mouth of the Keya Paha River, tributaries enter the Niobrara River only on its south side. In the parallel reach of Ponca Creek, drainage to that creek originates as close as a mile from the Niobrara River.

7. Some features of the Niobrara River suggest that segments of the present-day river formerly were segments of pre-existing rivers. Also, the steep gradients of some of the Niobrara's tributaries may be indicative of rapid downcutting by the Niobrara. Although not as spectacular as the Grand Canyon of the Colorado River, the Niobrara's deep valley may be due to downcutting in response to crustal uplift.

8. Snake River and Gordon Creek are nearly parallel and flow eastward throughout much of their length, then both veer sharply northward and drop steeply to the Niobrara River.

Most of the above features, along with several others not mentioned here, could be described as unusual or anomalous. Although some obviously are the result of the topography created by glaciation, others may be due to the rock types traversed or to warping or fracturing of the earth's crust. Evidence is mounting that some parts of Nebraska have tended to rise, some to have remained relatively stable, and others to have declined and that streams have had to adjust to these changes. It has been suggested that weighting of the earth's crust by continental ice sheets and rebound of the crust after the glaciers melted may account for some changes in the drainage pattern. Quite obviously, the course followed by the Missouri River and its extremely low gradient are the result of drainage changes imposed on the area by expanding ice sheets and by the altered terrain exposed after the last ice sheet melted.

Mapping of river terraces, determining their extent and relative levels, scrutinizing topographic maps for evidence of abandoned valleys and seemingly "underfit" valleys, constructing river and valley profiles, recording those reaches where streams are highly meandering or naturally nearly straight, depicting the shape of older land surfaces, and other approaches may, in time, provide evidence helpful in deciphering the history of Nebraska's drainage network.

Examination of the longitudinal profiles of Nebraska's principal streams and of selected tributaries (Plates 19-26) reveals that several do not match the idealized sketch. Seeming irregularities will be pointed out later in this report.

Relative discharges of Nebraska's principal rivers are indicated by line width on Plate 2. The Missouri is depicted in gray instead of black so it would not overwhelm the rivers that drain most of the State. Major canals are indicated by a stippled pattern; those canals not shown convey too little water to be represented by the same scale and pattern used. Obvious from this illustration is that the Platte River and its tributaries drain the largest part of Nebraska and account for most of the state's outflow to the Missouri. The Niobrara River ranks second in both respects. Areas drained and discharges of the Republican, Big Blue, Little Blue, Big Nemaha, and Little Nemaha rivers are all small compared to those of the Platte and Niobrara.

Of interest to some may be the differing relative altitudes of the principal rivers that cross Nebraska from west to east. (See Plate 4.) Although somewhat apparent from this generalized topographic map (contour interval 1,000 feet), more precise relationships are apparent from the following comparisons of altitudes where the rivers cross meridian lines: At the 104° meridian crossing, the North Platte is nearly 640 feet lower than than the Niobrara but at the 103° and 102° meridian crossings that difference has decreased, respectively, to about 280 feet and 60 feet. Farther east the North Platte-Platte rivers are higher than the Niobrara--by about 260 feet at the 101° meridian, by about 390 feet at the 100° meridian, by about 465 feet at the 99° meridian, and by about 490 feet at the 98° meridian. Back at the 102° meridian the North Platte is about 50 feet lower than the North Fork Republican River, but at the 101° meridian it is about 225 feet higher than the Republican. At the 100°, 99°, and 98° meridians, the Platte is, respectively, about 300 feet, 290 feet, and 115 feet higher than the Republican. Also at the 100° meridian, the Platte is about 70 feet higher than the Loup River which is tributary to the Platte about 35 miles downstream.

Other seeming anomalies are apparent on the topographic map: Despite the general eastward slope of the land surface, as indicated by the 2000- and 3000-foot contour lines, the Calamus, North Loup, Middle Loup, Mud Creek, and South Loup (all between those contours) flow southeasterly instead of eastward. The same is true of the Cedar River, Beaver Creek, and the Elkhorn River. Note also that both the Big Blue River southward from Butler County and the Missouri River southward from Sioux City flow contrary to the regional slope. However, the flow direction of their principal Nebraska tributaries does conform to that slope. The drainage pattern in the eastern part of Nebraska reflects in large measure a topography due to glaciation. As glaciers expanded, earth materials became incorporated in the ice, and when the glaciers melted those earth materials not carried away by meltwaters created a new landscape in the area that had been overriden by the glacier.

SOURCES OF STREAMFLOW

Although the discharge of most streams is derived partly from overland runoff and partly from groundwater seepage into the stream channel, the ratio of one source to the other differs from one reach of a stream to another and from one river to another. Generally speaking, the low flow of an unregulated stream is derived mostly or wholly from groundwater seepage and medium to large discharges are derived mostly from overland runoff events. If no diversions are made from an unregulated stream and that stream is characterized by periods of no flow, its periods of flow are due almost wholly to overland runoff.

Daily discharges of two streams whose mean annual discharges were nearly the same are illustrated graphically on Plate 3. The upper graph, for the Little Nemaha River at Auburn, represents a stream whose flow is largely dependent on overland runoff, and the lower, for the Calamus River near Burwell, represents a stream that is fed almost wholly by groundwater seepage into its channel. Note that the Little Nemaha River had a much greater range in discharges and that its low flow was much less than that of the Calamus River. Even so, some correspondence to widespread precipitation events is apparent. Since the monthly precipitation values shown on the graph are for only a spot location they should not be regarded as accurately indicative of <u>average</u> precipitation on the entire drainage basin.

Bar graphs showing annual mean discharges are those on plates 5 through 18. Despite storage in onstream reservoirs and diversions for irrigation and generation of hydroelectric power affecting the flow regimes at many stations, it is obvious that groundwater seepage is a significant component of the discharge of the following: Snake, Calamus, North Loup, Middle Loup, and Elkhorn rivers, and Birdwood Creek. Overland runoff is a more significant component of the flow of the Republican River, the Big Blue and and Little Blue rivers, and the Big Nemaha and Little Nemaha rivers. "Availability and use of water in Nebraska, 1975" a publication of the Conservation and Survey Division, contains graphic illustrations of the relative amount of groundwater and overland runoff in the discharge of Nebraska's principal rivers during the indicated year. Those relative amounts could be quite different in years either significantly wetter or drier than in 1975, which was a year of near-average precipitation.

SUMMARY OF STREAMFLOW DATA

In 1989, the most recent year for which records of stream discharges have been published, 160 gaging stations were operated. The locations of those stations are shown on Plate 1. Also shown in that same illustration are those parts of adjoining states that drain into Nebraska. Measurements of streamflow are reported in units of cubic feet per second and are published annually by the U.S. Geological Survey as daily mean discharges from October 1 of the year to September 30 of the succeeding year, a period designated as the "water year." The number of gaging sites has differed over the years, some stations having been added to the network and others discontinued. Table 1 summarizes all published stream-discharge records regardless of whether the gaging stations are currently operated or operations have been discontinued. Each gaging station is identified by a number and location name, and the stations are arranged in downstream order. The listed "water years of record" do not include any partial years.

Some comments about the tabulated information are pertinent:

1. Areas shown as noncontributing to streamflow are those not producing significant amounts of overland runoff. Such areas, however, generally contribute significant amounts of groundwater seepage to the stream above the gaging station. Drainage areas in the Sand Hills were computed from topographic maps, and since topographic divides may not conform to groundwater divides, those drainage areas may not be accurate. This disparity becomes apparent when one compares the discharges of Sand Hills streams in terms of their reported topographic drainage areas.
2. Average discharges may be misleading, especially those for streams whose flow is dependent largely on overland runoff. Infrequent events of high overland runoff can distort the averages. Median discharges for such streams are more nearly representative of streamflow amounts and thus are more suitable for comparing the discharge of one stream with that of another. Relatively few medians have been determined but are included in the table if they are available. Medians are significant only if the discharge record is for many years and if determined for a period during which no upstream development (such as storage reservoirs and/or large diversions) altered the flow regime. Also, comparison of stream-discharge averages should take into account the time periods for which the averages were computed. The discharge record for the Platte River near Duncan provides an example of the great difference in the averages for two different 5-year periods--699 cfs for the period 1953-57 and 4,472 cfs for the period 1983-87.
3. The wide disparity between instantaneous maximum and minimum daily discharges is indicative of the great range in discharge that has occurred during the period of record. It emphasizes the need for storage facilities to hold back as much of the large flows as possible for later release. Such regulation of streamflow is necessary if the discharge is to be regulated for maximum use.

4. As indicated by the statements under "Remarks", the natural flow of all the larger rivers, also that of many that are smaller, now is affected by upstream features such as diversions, hydroelectric power developments, diversions for irrigation, and return flows from irrigated lands. The flow of relatively few of the larger streams remains wholly natural.

Establishment of most gaging stations has been at the request of some Federal or State agency that had a need for information on stream discharge at a given location. Gaging at a few more than 130 gaging stations has been discontinued because additional information was no longer needed. Administration of water rights and feasibility of building dams to store water are the principal needs for streamflow data. However, some stations have been established to collect data for later comparison with data collected after water resources developments have occurred.

The U.S. Geological Survey's annually published "Water Resources Data for Nebraska" includes records of discharge of many "partial record stations" and in some years has published results of low-flow studies that provide valuable clues to the amount of groundwater discharged into streams. The same reports also contain data on the chemical quality and sediment load at many locations. Four gaging stations--4655, 8055, 8808, and 8840.25--are included in the National Stream Quality Accounting Network and 57 other stations are in the Hydrologic Bench-mark Network. The former network is nation wide and designed to meet information needs of government agencies and other groups involved in national or regional water-quality planning and management. Most of the streams in this network are located at the downstream end of so-called hydrologic accounting units. Those stations in the latter network are at the downstream end of undeveloped drainage basins and the data collected are useful for comparison with similar data from basins obviously affected by man's activities. Data collection at several stations in this latter network was discontinued at the end of the 1989 water year.

Not included in table 1 are data on water-surface elevation and contents of reservoirs.

Hydrographic reports published annually by the Nebraska Department of Water Resources present records of storage in reservoirs and the daily discharge of streams and canals not published in the U.S. Geological Survey's water-data reports. Time did not permit incorporation of any data from those reports.

HISTORICAL STREAMFLOWS

Hydrographs showing annual mean discharges for full periods of record at several gaging stations are shown on plates 5 through 18. One or another of the following features of a station's record determined whether it would be selected for depiction: (1) average discharge has been greater than 100 cfs; (2) period of record is of long duration; (3) record illustrates the effect of upstream development(s). Comments relating to each of the hydrographs are as follows:

4595 Snake River near Burge. (Plate 5)
Nearly uniform annual mean discharges prior to 1963 are characteristic of a Sand Hills stream. Since then, average discharge has been reduced by diversion for irrigation in the vicinity of Ainsworth and has been less steady.

4615 Niobrara River near Sparks. (Plate 5)
4650 Niobrara River near Spencer. (Plate 5)
4655 Niobrara River near Verdel. (Plate 5)
Together these hydrographs illustrate the downstream increase in the discharge of the Niobrara River. Because overland runoff becomes a progressively larger component of the river's discharge, the hydrograph for gaging station 4655 is less uniform than that for gaging station 4615. A large part of the inflow from Fairfield, Plum, and Long Pine creeks is derived from groundwater, but from other tributaries is less so. At its mouth the Niobrara contributes more than a million acre-feet of good quality water to the flow of the Missouri River.

4647 Keya Paha River near Naper. (Plate 5)
The range in annual mean discharges and the very low discharge in some years indicate that the Keya Paha's flow is due largely to overland runoff.

6745 North Platte River at Wyoming, Nebraska State line. (Plate 6)
6845 North Platte River at Bridgeport. (Plate 6)
6875 North Platte River at Lewellen. Plate 6)
Where the North Platte River enters Nebraska its discharge already has been lessened greatly by diversions through tunnels to the South Platte Rivers' drainage basin, also by storage reservoirs and diversions for irrigation in Wyoming. However, a significant part of the diversions are for irrigation in Nebraska and return flow from the land thus irrigated has augmented the flow of several tributaries to the North Platte River in Nebraska. Thus, a significant part of the North Platte's flow at the upstream end of Lake McConaughy is return flow from irrigation. Lake McConaughy is much used for fishing and water sports.

6905 North Platte River near Keystone. (Plate 7)
River discharge at this station has been greatly lessened by diversion into the Sutherland Canal. The large mean discharges in some years are due mostly to snowmelt that was too great to be wholly stored in Lake McConaughy and so had to be bypassed. The hydrographs of downstream gaging stations show that these large discharges were transmitted to the Platte River's mouth and there added to the flow of the Missouri River.

6920 Birdwood Creek near Hershey. (Plate 7)
The nearly equal annual mean discharges of this stream indicates that its flow is due almost wholly to groundwater seepage into its channel.

6930 North Platte River at North Platte. (Plate 7)
This long record illustrates the large reduction of flow due first to the drought of the 1930's and subsequently to the completion of Keystone Dam and diversion, between the dam and Keystone, to the Sutherland Canal.

7640 South Platte River at Julesburg, Colo. (Plate 8)
A wide range in annual mean discharges is obvious from this hydrograph. The mean discharge in water year 1983 (2882 cfs) was about 37 times greater than that in water year 1956 (76.3 cfs). Only by providing for additional upstream storage could make the South Platte's flow be regulated to better advantage downstream.

7655 South Platte River at North Platte. (Plate 8)
Because the drought of the 1930's and the wet years in the 1980's, the mean discharge after 1947 was slightly larger than it was before part of the river's flow was diverted via the Korty Canal to the Sutherland Canal. This emphasizes the fallacy that can result from comparing the mean discharge during one period to that during another. Diverting water out a river hardly would cause an increase in the river's downstream average discharge, but this hydrograph would <u>seem</u> to demonstrate otherwise!

7660 Platte River at Brady. (Plate 8)
The Platte's discharge here has been reduced considerably because much of the river's flow is diverted into the Tri-County Supply Canal close below the confluence of the North Platte and South Platte rivers. Note again the very large mean discharges in 1983 and 1984 because upstream reservoirs had insufficient storage capacity to hold back the excessive runoff.

7665 Platte River near Cozad. (Plate 9)
Despite return to the river of water that had passed through the Jeffrey Power Plant, the average discharge of the river at Cozad is somewhat less than that at Brady. Diversion into several irrigation canals between the two stations accounts for this decrease. However, in the years when average discharge was much greater than normal, the mean discharges were greater at Cozad than at Brady. Because the large discharges occurred in advance of the irrigation season, no diversions were being made.

7680 Platte River near Overton. (Plate 9)
Because record keeping at this site began 26 years before storage began in Lake McConaughy, the year that filling began would be apparent without its being labelled. The low annual mean discharges during the 1930's, the middle 1950's, and the last half of the 1970's characterize drought periods and the very high discharges during the 1983 and 1984 water years were due to greater-than-normal snowmelt and to precipitation upstream. The large gain in the annual average discharges between Cozad and Overton is due to return to the river of part of the water diverted into the irrigation canals that divert from the river in Dawson County.

7705 Platte River near Grand Island. (Plate 10)
The average discharge at this station in the 1942-89 period is a little less than at Overton. Loss of flow between the stations probably is due to seepage of river water into the underlying and adjoining aquifer.

7740 Platte River near Duncan. (Plate 10)
Comparison of this hydrograph with that for the gaging station near Grand Island indicates a gain in flow within the intervening distance. This gain is due principally to the inflow of several tributaries and possibly to groundwater seepage at times when precipitation caused the adjacent water table to rise to a level higher than that of the river. Comparison of monthly mean discharges at the two stations indicates gains in some months and losses in others, the monthly gains outweighing the losses.

7755 Middle Loup River at Dunning. (Plate 11)
7765 Dismal River at Dunning. (Plate 11)
Both hydrographs illustrate the steadiness of flow in these two Sand Hills streams. Since only a small part of their drainage areas contributes overland runoff, their flow is due almost wholly to seepage of groundwater into their channels. At one location on the Dismal, water emerging from a natural large-diameter deep conduit contributes significantly to the river's flow.

7781 South Loup River at St. Michael. (Plate 11)
About 73 percent of the drainage area at this gaging station produces overland runoff, hence the river's discharge at this location is more variable than that of the Middle Loup and Dismal rivers at Dunning. The principal tributary to the South Loup upstream from St. Michael is Mud Creek, the discharge of which is almost entirely overland runoff.

7850 Middle Loup River at St. Paul. (Plate 11)
Because this gaging station is downstream from the eastern margin of the Sand Hills, the discharge at this location consists partly of groundwater and partly of overland runoff. Although diversions to the Sargent and Middle Loup irrigation projects and into the Sherman Feeder Canal deplete flow in the river, the effect of these diversions is not very obvious in the hydrograph but is shown by the indicated average discharges for three successive periods.

7860 North Loup River at Taylor. (Plate 11)
Because the area drained by the North Loup at this gagins site is entirely within the Sand Hills, river flow at this gaging station is derived almost wholly from groundwater. Beginning in 1939, diversion to the Taylor-Ord Canal (5 miles upstream) has depleted the river's flow at this location.

7875 Calamus River near Burwell. (Plate 12)
Overland runoff to the Calamus River is minimal because the area drained is wholly within the Sand Hills. As at other gaging stations within the Sand Hills or near the Sand Hills margin, the discharge is due almost wholly to groundwater seepage into the river and therefore nearly steady.

7905 North Loup River near St. Paul. (Plate 12)
Prior to 1939, flow of the North Loup River at this location was little affected by diversions for irrigation. However, the drought of the 1930's did cause a noticeable depletion of discharge at this station. Beginning in 1939, diversions into these canals has depleted the river's flow somewhat, but the effect of these diversions is not visually apparent from the hydrograph. Groundwater seepage into the river channel is a large component of the river's discharge.

7920 Cedar River near Fullerton. (Plate 12)
Because the Cedar River rises inside the Sand Hills region, its flow in its upper reaches is due mostly to groundwater seepage. Downstream from the Sand Hills margin, overland runoff progressively contributes more to the river's discharge. Several small diversions deplete flow, mostly during the height of the growing season.

7945 Loup River at Columbus. (Plate 12)
River flow at Columbus is very noticeably depleted by year-round diversions into the Loup River Power District Canal. The amount of water diverted into that canal has been added to the annual bars so as to show how great the river's flow would have been if the large diversion did not occur. Most of the diverted water is discharged to the Platte River a short distance downstream from the Loup's mouth. Beginning in 1938, diversions for irrigation also has depleted the river's flow.

7960 Platte River at North Bend. (Plate 13)
Inflow from the Loup River and from the Loup River Power District canal plus inflow from Clear Creek and several other small tributaries more than doubles the discharge of the Platte River between the Duncan and North Bend gaging stations. Virtually no water is diverted from the Platte River between Duncan and North Bend.

8035.55 Salt Creek at Greenwood. (Plate 13)
After the disastrous flood of 1951 at Lincoln, the U.S. Corps of Engineers constructed 10 dams on tributaries in the upper parts of the basin to minimize future flooding. In addition, the Soil Conservation Service promoted contour plowing and construction of detention dams to lessen transport of sediment into the reservoirs and to slow runoff to tributaries of Salt Creek and to Salt Creek itself. The entire record for Salt Creek's discharge is subsequent to the start of construction of these runoff retarding features. The reservoirs are much used for recreation.

7985 Elkhorn River at Neligh. (Plate 14)
7990 Elkhorn River near(at) Norfolk. (Plate 14)
7993.5 Elkhorn River at West Point. (Plate 14)
7995 Logan Creek near Uehling. (Plate 14)
8005 Elkhorn River at Waterloo. (Plate 14)

The hydrographs for the four stations on the Elkhorn River illustrate the downstream increase in the river's discharge. Since only small amounts of water are diverted for irrigation and only one dam has been constructed (on Willow Creek, a tributary of the North Fork), the river's flow is virtually natural.

Logan Creek, a tributary entering the Elkhorn River between West Point is sometimes referred to as the Logan Dredge because the river now flows in an artificial channel for nearly its entire length. The natural channel of Logan Creek was highly meandering and had such a low gradient that flooding was a frequent occurrence. Outflow from Logan Creek's long valley has been facilitated by the dredging of the new channel. The flow of Logan Creek is almost wholly due to overland runoff.

8010 Platte River at (near) Ashland. (Plate 15)
This hydrograph is a composite of discharge records that approximate the flow of the Platte River near its mouth. It might more logically be titled "Platte River at South Bend" because the Ashland station is no longer operated and the discharge record for the station at South Bend is about half the record illustrated. The full height of each annual bar in the graph represents the approximate discharge of the Platte but the bars are subdivided into three segments to show how much of the total discharge was contributed by the Loup and Elkhorn rivers. Of the Nebraska rivers tributary to the Missouri River, the Platte is by far the largest contributor. Several years ago the U.S. Corps of Engineers proposed damming the Platte near Ashland so as to control both outflow and sediment discharge to the Missouri.

8285 Republican River at Stratton. (Plate 16)
Because Stratton is located a short distance upstream from Swanson Lake, an onstream reservoir, this hydrograph is a record of inflows to that reservoir. The river's discharge at Stratton is affected by storage in Bonny Reservoir (on the South Fork of the Republican River in eastern Colorado) and by diversions for irrigation.

8370 Republican River at McCook. (Plate 16)
[Note: record is for only 36 years, not the indicated 59 years].
McCook is located downstream from the mouth of tributaries Frenchman Creek, Blackwood Creek, and Driftwood Creek. Enders dam on Frenchman Creek stores water for diversion into the Culbertson Canal, so the contribution of Frenchman Creek to the flow of the Republican is markedly less than it was before 1950, when storage began. The discharge of Driftwood Creek also is affected by irrigation developments, but the discharge of Blackwood Creek is only slightly so affected. The Republican's discharge at McCook has not been gaged long enough to provide information on its discharge prior to upstream developments.

8435 Republican River at Cambridge. (Plate 16)
8435 Republican River at Orleans. (Plate 16)
River discharge at both of these stations is much affected by upstream storage, diversions into irrigation canals, and return flows. At neither station is the record long enough to provide information on pre-development flow characteristics.

8495 Republican River below Harlan County Dam. (Plate 16)
8505 Republican River near Bloomington. (Plate 16)
8530.2 Republican River at (near) Guide Rock. (Plate 17)

At each of these gaging stations, discharge is controlled by releases from Harlan County Lake and by diversions into irrigation canals.

8535 Republican River near Hardy. (Plate 17)

Only at this gaging station is the record long enough to provide any inkling of the river's discharge before major developments occurred. Compared to the Niobrara and Loup Rivers, the Republican has much less groundwater contributed to its flow. Its average discharge of 898 cfs during the 1933-52 period is much less than the average of the Niobrara and Loup rivers at their mouth, even though their drainage areas are significantly smaller than that of the Republican.

8115 Little Nemaha River at Auburn. (Plate 17)
8150 Big Nemaha River at Falls City. (Plate 17)

Because the flow at both of these stations is due largely to overland runoff, the annual mean discharges are highly variable. the areas drained by both streams are in the part of Nebraska that generally receives the most precipitation.

8808 West Fork Big Blue River near Dorchester. (Plate 18)
8810 Big Blue River near Crete. (Plate 18)
8815 Big Blue River at Beatrice. (Plate 18)
8820 Big Blue River at Barneston. (Plate 18)
8840 Little Blue River near Fairbury. (Plate 18)

Although much groundwater is pumped for irrigation in the drainage basins of the Big Blue and Little Blue rivers, that pumping has not had an appreciable effect on river flow. However, direct pumping from the rivers sometimes depletes flow so much that administration of water rights is necessary.

LONGITUDINAL PROFILES OF NEBRASKA RIVERS

If, throughout its length, a river flows across earth materials (consolidated rocks and/or unconsolidated sediments) that are equally erodible, the river's profile from head to mouth theoretically should be similar to that illustrated in the introductory paragraph. However, many streams flow across rocks that differ in erodibility or flow through areas of structural unrest and therefore have profiles differing from the theoretical or idealized profile. Examination of plates 19 to 26 reveals that some Nebraska rivers have a profile approximating the idealized sketch and that others have a profile that departs somewhat or even markedly from it.

Features distinguishing individual profiles are described as follows:

Plate 19. Throughout its course along Nebraska's eastern border, the Missouri River has an average gradient of about 1 foot per mile. So low a gradient indicates that it nearly parallels the contours of Nebraska's slope from west to east. Quite likely its course marks the western margin of a continental glacier which persisted long enough for the river to cut so deep a valley along the ice edge that it could not return to its preglacial course after the glacier melted back.

The minor irregularities in the profiles of the Big Nemaha and Little Nemaha rivers and of Weeping Water and Papillion creeks probably are due to differences in the erodibility of the rocks into what they are cutting their valleys.

The profile of Ponca Creek downstream from the South Dakota-Nebraska state line is nearly the same as that of the Niobrara's lowest reach.

Plate 20. Differences in the gradient of one reach to another of the Niobrara River as it crosses the northern part of Nebraska may be the result of crustal adjustment. Changes in gradient appear to have occurred immediately upstream and downstream from Spencer Dam.

Note that the gradient of the Keya Paha River is less than that of the Niobrara but that the gradients of other tributaries are much steeper. Also note that the profile of Verdigre Creek is slightly concave, that the profile of Long Pine Creek is nearly straight, that the profiles of of Fairfield, Minnechaduza, and Bear creeks, also of the Snake River (mislabelled "creek"), are convex and that the profile of Box Creek is concave. Although some of the irregularities in the profiles are due to differences in the erodibility of the rocks traversed by the streams, the steepness of these streams quite likely reflects relative crustal uplift, as also do their deep and steep-walled valleys.

Except for steepening at its lower end, the profile of Box Butte Creek approaches that of the idealized sketch.

Plate 21. Progressive upgradient steepening is indicated by the profiles of the Platte and South Platte rivers but not of the North Platte. Profiles of the Wood River, North Plum-Plum, Birdwood, Blue, and Pumpkin creeks differ, but only those of Birdwood and North Plum-Plum creeks approximate the idealized sketch. Possibly differing erodibility of the rocks traversed accounts for some of the irregularities and crustal unrest for the others.

Plate 22. From the mouth of the Loup River to the junction of the North Loup and Middle Loup rivers, the Loup's gradient is less than that of the Platte, to which the Loup is tributary. Note that upstream from that junction, the gradient of the North Loup does not

steepen uniformly, but that the gradients of the Middle Loup and of its tributary, the South Loup, do increase progressively. The rather sharp increase in the gradients of the Middle Loup and Dismal rivers toward their upper end may reflect crustal uplift along the Chadron-Cambridge Arch.

Beaver Creek and the Cedar River have profiles that steepen only slightly in the upgradient direction.

If the upper part of the Goose Creek had not been straightened, a profile of that creek before straightening probably would be convex instead of nearly straight.

The profile of Mud Creek, a tributary of the Middle Loup, has some minor irregularities but otherwise closely resembles the idealized profile.

Plate 23. The Elkhorn River's profile steepens markedly upstream but not markedly so in its uppermost reach, where the river has been artificially lengthened.

Maple Creek, Logan Creek dredge, and the North Fork Elkhorn River differ in steepness of gradient, but their profiles all steepen progressively upstream. As pointed out earlier, Logan Creek dredge is an artificial channel for the natural Logan Creek, which had a much lower gradient and was longer than the dredged channel. Note how much the profile of the still-natural North Branch of Logan Creek differs from the profile of the dredge.

The distinctive profile of the South Fork Elkhorn River may be due to a "bedrock high" that the stream skirts instead of cutting through it.

Plate 24. Except for that of Beaver Creek, the profiles of the Republican River and of other tributaries indicate progressive upstream steepening of gradient.

Deposition of sediment may be indicated by the downstream decrease in gradient immediately above the following onstream reservoirs: Harlan County Reservoir on the Republican River, Harry D. Strunk Lake on Medicine Creek, and Enders Reservoir on the Frenchman River. Some of the other small irregularities in gradient may reflect crustal unrest.

Plate 25. Compared to the other rivers within Nebraska, the Big Blue River has a lower gradient.

Big Indian Creek (except in its uppermost reach), Lincoln Creek, West Fork Big Blue River, and Lincoln Creek, which are the principal streams entering the Big Blue from the west, have gradients closely matching the eastward continental slope into which they have incised their valleys.

Wildcat and Plum creeks, which enter the Big Blue from its east side, are short and much steeper than the Big Blue, whereas the lower two-thirds of the North Fork Big Blue is less steep than the Big Blue near their junction. Note the nearness of the head end of the Big Blue River and of Lincoln Creek to the Platte River, which there flows at a lower elevation.

Plate 26. Both the White River and Hat Creek have very steep gradients where they are cutting their valleys into strata of Tertiary age and have lesser gradients where they flow over the Cretaceous Pierre Shale. White Clay Creek is cutting its valley into Tertiary age rocks throughout its length within Nebraska. All three of these creeks drain Pine Ridge, a structural feature that is part of the Black Hills uplift.

Snake Creek heads in eastern Sioux county, traverses Box Butte County, and ends in southwestern Sheridan County; it is not tributary to any stream.

Lodgepole Creek heads in southeastern Wyoming, flows across the southern part of the Nebraska panhandle, and becomes a tributary to the South Platte River between Julesburg and the Colorado-Nebraska state line. Its gradient is less steep between Sidney and Lodgepole than elsewhere along its reach in Nebraska.

DYNAMIC "OPERATORS"

"Base level" denotes the lowest level at which a river, at its mouth or at some point along it, can erode a deeper channel. Base levels are not necessarily constant over time, and if a base level is lowered, the river begins to cut its valley deeper. Conversely, if a base level rises, the river alluviates its valley (i.e., deposits its sediment load) until a new equilibrium is reached.

Terraces along rivers represent former floodplains that developed when, at earlier times, the river's base level was higher than it is now. For example, remnants of several terraces border the North Platte River, and since the gradient of these former floodplains do not parallel the present-day floodplains, it is obvious that the river not only has flowed at higher levels than now but also that the river's gradient has changed with time.

Some of Nebraska's rivers flow on thick deposits of alluvium, thus indicating that the river previously flowed at lower levels than now. It is reasonable to surmise that the alluvium consists of a series of floodplain deposits that accumulated as the base level of the river was rising.

Construction of a dam across a river creates an artificial base level. Upstream from the dam, the river responds by depositing its sediment load and gradually building up a higher flood plain, and downstream from the dam the released water has an increased power to erode. As pointed out in the remarks about some river profiles, response to dam construction was already evident when Nebraska's topography was mapped.

TABLE 1a

Summary of recorded discharge at gaging stations on Nebraska streams

Station name and number	Drainage area[1] (square miles)		Water years of record	Discharge, in cubic feet per second				Remarks
	Total	Non-contributing		Average[2]	Median	Instantaneous maximum	Minimum daily	
4440 White River at Crawford	313		1932-43;1947-89	20.2		1,580	2.7	
4450 White River below Cottonwood Creek	676		1949-61	19.7		4,480	0	Flow affected by diversions, offstream storage in Whitney Reservoir, and return flow from irrigated areas
4455 White River near Chadron	750		1932-43	26.4		3,690	0	Do.
4455.9 Big Bordeaux Creek near Chadron	9.42		1969-79	.56		5,670	0	
4534 Ponca Creek near Naper	373		1968-79	29.0				
4535 Ponca Creek at Anoka	505		1950-89	47.0	34.0	9,810	0	
4535.5 Ponca Creek at Lynch	---		1961-64	104.4[3]		5,860	.05	
4536 Ponca Creek at Verdel	812		1957-89	79.3	62.0	15,700	0	
4540 Niobrara River at Wyo-Nebr state line	450		1955-89	3.72		2,120	.54	Diversions for irrigation of about 4,700 acres upstream from station
4541 Niobrara River at Agate	840		1957-89	13.7		181	1.0	Diversions for irrigation of about 6,700 acres upstream from station
4545 Niobrara River above Box Butte Reservoir	1,400		1947-89	29.1		4,950	1.6	Diversions for irrigation of about 12,800 acres upstream from station
4550 Niobrara River below Box Butte Reservoir	1,460		1947-89	250		616	.10	Flow completely regulated by Box Butte Reservoir
4559 Niobrara River near Dunlap	1,580		1931-42;1962-71	38.4		3,230	.60	Flow regulated by Box Butte Reservoir since Oct 1945
4565 Niobrara near Hay Springs	1,790		1950-64	28.2		7,330	2.7	Flow regulated by Box Butte Reservoir and diversions to Mirage Flats
4585 Bear Creek near Eli	360	282	1949-50	7.82		138	<1.0	
4590 Niobrara River near Cody	5,570		1947-57	320		4,170	40	Flow affected by storage in Box Butte Reservoir and irrigation developments
4591.75 Snake River at Doughboy	405	379	1982-89	166		277	100	
4592 Snake River above Merritt Reservoir	440	412	1963-81	203		637	89	
4595 Snake River near Burge	660	616	1947-89	255(1947-65) 154(1964-89)		3,170	5.8	
4605 Niobrara River near Valentine	6,160		1902-6;1929-32	838				
4609 Minnechaduza Creek near Kilgore	85		1958-74	7.19		147	0	
4610 Minnechaduza Creek at Valentine	390		1948-49	34.1		1,100	2.3	Flow regulated by power plant 500 ft upstream from station
4615 Niobrara River near Sparks	8,090		1945-89	772		10,200	100	Flow affected by storage in Box Butte and Merritt reservoirs and by upstream irrigation developments
4620 Niobrara River near Norden	8,390		1953-83	860		9,600	130	Do.
4625 Plum Creek at Meadville	600	260	1948-75;1977-89	118		2,070	15	
4630 Niobrara River at Meadville			1951-52	1,190		6,640	390	Do.
4630.8 Long Pine Creek near Long Pine	246		1980-89	102		507	77	Small diversions for irrigation upstream from station
4635 Long Pine Creek near Riverview	460		1948-53;1954-89	146		9,650	44	Flow includes return water from Ainsworth Irrigation Project
4637.2 Niobrara River at Mariaville	9,810		1986-89	1,410		6,200	748	
4645 Keya Paha River at Wewela	1,070		1939-40;1948-89	71.7	59.0	5,430	0	

TABLE 1b

Summary of recorded discharge at gaging stations on Nebraska streams (continued)

Station name and number	Drainage area[1] (square miles) Total	Non-contributing	Water years of record	Discharge, in cubic feet per second Average[2]	Median	Instantaneous maximum	Minimum daily	Remarks
4649 Keya Paha River near Naper	1,630		1958-89	140	120	9,780	0	Small diversions for irrigation upstream from station
4650 Niobrara River near Spencer	12,100		1914;1928-36; 1941-89	1,430		27,400	5	Flow affected by diversions for irrigation and power development
4653.1 Eagle Creek near Redbird	206		1979-89	53.1		3,330	1.9	
4654.4 Redbird Creek at Redbird			1980-89	42.3		2,120	3.8	
4655 Niobrara River near Verdel	12,600		1914;1928-36; 1941-89	1,584		39,000	104	Flow affected by upstream irrigation and power developments
4656.8 North Branch Verdigre Creek	137		1980-89	25.7		315	2.5	Flow affected by small upstream diversions for irrigation
4660 Niobrara River at Niobrara			1955-57	1,714		16,900	90	Flow affected by upstream irrigation and power developments
4665 Bazile Creek near Niobrara	440		1953-89	83	71.0	68,600	0	Flow affected by small upstream diversions for irrigation
4675 Missouri River at Yankton, S. Dak	279,500		1931-89	26,620		480,000	2,700	Flow regulated by Gavins Point Dam, 5.2 miles upstream
4785.18 Bow Creek near St. James	304		1978-89	76.6	60.0	21,400	6.1	
4860 Missouri River at Sioux City	314,600		1897-89	31,970		441,000	2,500	Flow now regulated by upstream reservoirs
6010 Omaha Creek at Homer	168		1946-89	37.8	32.0	18,100	0.1	
6011 Blackbird Creek near Macy	102		1979-80	18.3		3,820	2.5	
6012 Missouri River at Decatur	316,200		1988-89			40,600	8,260	Do.
6090 New York Creek at Herman	25.4		1947-69	6.82		5,500	0	
6100 Missouri River at Omaha	322,800		1929-89	30,850		386,000	2,200	Do.
6745 North Platte River at Wyo-Neb state line	22,218	1,929	1930-89	810		17,900	13	Flow regulated by upstream transmountain diversions, storage reservoirs, power development, groundwater withdrawals and diversions for irrigation, and return flows from irrigated areas
6750 North Platte River at Henry			1914-15	1,795				
6771 Horse Creek at Wyo-Neb state line			1970	43.2		463	3.4	
6773 Kiowa Creek near Lyman			1962-65	36.2		1,780	3.9	Flow affected by spills from canals, diversions for irrigation, and return flow from irrigated areas
6775 Horse Creek near Lyman	1,570	40	1932-89	75.4		5,110	0.4	Flow affected by groundwater withdrawals for irrigation and return return flow from irrigated areas
6780 Sheep Creek near Morrill	362	25	1932-89	55.2		516	0.1	Do.
6790 Dry Spotted Tail Creek at Mitchell	77.2		1947-79	34.1		2,010	1.6	Do.
6795 North Platte River at Mitchell	24,300	2,000	1902-10;1921-89	2448(1902-10) 956(1921-57) 862(1958-89)	546	27,500	25	Flow affected by transmountain diversions, storage reservoirs, power reservoirs, power developments, groundwater withdrawals, return flow from irrigated areas
6800 Tub Springs near Scottsbluff			1949-79	37.6		1,610	.70	Flow affected by diversions for irrigation, spills from Enterprise Canal, and return flow from irrigated areas
6807 Winters Creek at Tri-State Canal near Scottsbluff			1962-65	29.3		630	12	Flow affected by diversions for irrigation and return flows from irrigated areas
6810 Winters Creek near Scottsbluff			1932-79	52.9		1,160	.9	Do.
6820 North Platte River near Minatare	24,700	2,000	1918;1924-89	1129(1924-57) 1099(1958-89)	802	16,200 14,900	11 21	Flow affected by transmountain diversions, storage reservoirs, power reservoirs, power developments, groundwater withdrawals, return flow from irrigated areas

TABLE 1c

Summary of recorded discharge at gaging stations on Nebraska streams (continued)

Station name and number	Drainage area[1] (square miles)		Water years of record	Discharge, in cubic feet per second				Remarks
	Total	Non-contributing		Average[2]	Median	Instantaneous maximum	Minimum daily	
6840 Red Willow Creek near Bayard			1932-79	88.5				
6845 North Platte River at Bridgeport	25,300	2,000	1903-6;1917-89	3002(1903-6)		20,400		Flow affected by transmountain diversions, storage reservoirs,
				1584(1917-57)		24,000	55	power developments, groundwater withdrawals, diversions for
				1379(1958-89)	1,056	16,400	70	irrigation, and return flow from irrigated areas.
6850 Pumpkin Creek near Bridgeport	1,020		1932-89	27.2		7,880	0	Flow affected by groundwater withdrawals, diversions for irrigation, and return flow from irrigated areas
6860 North Platte River at Lisco	26,700	2,000	1932-89	1199(1932-57)		12,100	8	Flow affected by transmountain diversions, storage reservoirs,
				1459(1958-89)	1,160	13,200		power developments, groundwater withdrawals, diversions for irrigation, and return flow from irrigated areas
6865 North Platte River at Oshkosh		2,000	1929-60	1319		19,500	0	Do.
6870 Blue Creek near Lewellen	1,190	1,110	1930-89	69.0		720	0	Flow affected by groundwater withdrawals, diversions for irrigation, and return flows from irrigated areas
6875 North Platte River at Lewellen	28,600		1942-89	1559(1958-89)	1,280	13,500	44	Flow affected by transmountain diversions, storage reservoirs, power development, groundwater withdrawals, diversions from irrigation, and return flow from irrigated areas
6880 North Platte River at Belmar			1918;1921-25	3525(1921-25)		23,000		
6885 Otter-Creek near LeMoyne			1933-37	22.2				
6890 North Platte River at LeMoyne			1926-27	3,405		10,700		Flow affected by storage reservoirs, diversions for irrigation, and return flow from irrigated areas
6895 North Platte River at Martin			1934-38	1,204		16,400	0	
6905 North Platte River near Keystone	29,300	3,500	1943-89	531	365			Flow affected by transmountain diversions, storage reservoirs, power developments, groundwater withdrawals, diversions for irrigation, and return flow from irrigated areas
6910 North Platte River near Sutherland	29,800	3,680	1937-89	609(1937-42)	361	3,770(1937-42)	0	Do.
				535(1943-89)		6,870(1943-89)	9	
6915 Birdwood Creek near Sutherland			1914-15	167		293		
6920 Birdwood Creek near Hershey	940	860	1932-89	151		1,770	61	Flow affected by groundwater withdrawals, diversions for irrigation, and return flow from irrigated areas
6930 North Platte River at North Platte	30,900	4,600	1896-89	2618(1896-42)		29,600	97	Flow affected by transmountain diversions, storage reservoirs,
				775(1943-89)	600(1943-89)	9,580		power developments, groundwater withdrawals, diversions, and return flow from irrigated areas
7625 Lodgepole Creek at Bushnell	1,350		1932-89	10.4		16,500	0.09	Flow affected by groundwater withdrawals, diversions for irrigation, and return flow from irrigated areas
7635 Lodgepole Creek at Ralton	3,307		1952-79	6.31		4,560	0	Do.
7640 South Platte River at Julesburg	23,193		1903-89	546		37,600	0	Flow affected by transmountain diversions, storage reservoirs, power deavelopments, groundwater withdrawals, diversions for irrigation, and return flow from irrigated areas
7648 South Platte River at Roscoe			1983-89	1,265		14,700	0.5	Do.

Summary of recorded discharge at gaging stations on Nebraska streams (continued)

Station name and number	Drainage area[1] (square miles)		Water years of record	Discharge, in cubic feet per second				Remarks
	Total	Non-contributing		Average[2]	Median	Instantaneous maximum	Minimum daily	
7650 South Platte River at Paxton			1932-33;	160(1932-33)				Do.
			1940-69	226(1940-69)		33,800	0	
7655 South Platte River at North Platte	24,000		1918-89	435(1918-46)		37,100(1918-46)	0	
				453(1947-89)	283(1947-89)	22,200(1947-89)	35	Do.
7660 Platte River at Brady	56,200		1939-89	1020(1939-41)		8,670	0	Do.
				790(1942-89)	374(1942-89)	23,500(1942-89)	33	
7665 Platte River near Cozad	56,500	4,800	1940-89	701(1942-89)	325	21,500	0	Do.
7670 Platte River near Lexington	61,300		1903-06;	3730(1903-06)				
			1918-24	3637(1918-24)		35,600	0	Do.
7675 Plum Creek near Smithfield	229		1947-53; 1969-75	6.72	3.0	462	0	
7680 Platte River near Overton	57,700	4,800	1915-89	2765(1915-41)	2730(1915-41)	37,600	0	Do.
				1649(1942-89)	1224(1942-89)			
7685 Buffalo Creek near Darr	63		1947-69	4.22	3.7	9,000	0	
7690 Buffalo Creek near Overton	175		1950-58	14.0		383	0	Flow affected by upstream spills from irrigation canals and small diversions by pumping
7695 Elm Creek near Overton	31		1947-58	2.0		8,000	0	
7700 Platte River near Odessa	58,100	4,800	1938-89	1567(1942-89)	1220(1942-89)	22,900	0	Flow affected by transmountain diversions, storage reservoirs, power developments, groundwater withdrawals, diversions for irrigation, and return flow from irrigated areas
7701.9 North Dry Creek near Kearney			1969-71	12.2		395	1.0	
7702 Platte River near Kearney	58,200	4,800	1983-89	3010		23,700	14	Do.
7704.78 Platte River near Grand Island (South Channel)			1984-87	1633		110	23	Do.
7705 Platte River near Grand Island	58,800	4,800	1934-89	866(1934-41)		30,000(1934-41)		
				1598(1942-89)	1190(1942-89)	23,900(1942-89)	0	Do.
7710 Wood River near Riverdale	379		1947-73	12.5	6.9	20,000	0	
7715 Wood River near Gibbon	572		1949-76	13.3	8.3	4,050	0	
7720 Wood River near Alda	628		1954-89	10.6	8.1	1,630	0	
7730 Dry Creek near Cairo	22.2		1949-53	3.2		586	0	
7735 Prairie Creek near Silver Creek	406		1949-53	28.0		1,070	0	
7740 Platte River near Duncan	60,900	4,800	1901-09	3,859		44,100	0	
			1913-15	3,013		24,400	0	
			1929-41	1,444		30,000	0	
			1942-89	1,787	1370(1940-89)	25,400	0	
7745 Middle Loup River near Mullen	1,120		1947-48	135				
7750 Middle Loup River near Seneca	1,140		1948-53	199				
7755 Middle Loup River at Dunning	1,850	1,770	1946-89	409		1,020	100	Discharge of 2,160 cfs resulting from bridge collapse and resulting ice jam
7759 Dismal River at Thedford	960	930	1967-89	196		1,160	125	
7760 Dismal River near Gem	1,360		1947-53	278				

TABLE 1e

Summary of recorded discharge at gaging stations on Nebraska streams (continued)

Station name and number	Drainage area[1] (square miles) Total	Drainage area (square miles) Non-contributing	Water years of record	Discharge, in cubic feet per second Average[2]	Median	Instantaneous maximum	Minimum daily	Remarks
7765 Dismal River at Dunning	2,040	1,995	1946-89	326		1,290	100	
7770 Middle Loup River near Milburn	3,690	3,555	1952-56;1958; 1961-64	795		2,440	260	
7775 Middle Loup River at Walworth	4,340	3,910	1941-60	798		2,990	48	Flow affected by upstream diversion to Sargent Irrigation District and numerous small diversions for irrigation
7780 Middle Loup River at Sargent	4,480	4,005	1938;1953	820		3,400	97	Flow affected by upstream diversions for irrigation and return flows from irrigated areas
7790 Middle Loup River at Arcadia	5,040	4,220	1938-89	803(1938-61) 697(1962-89)		18,500(est) 7,700(1962-89)	92 6	Do.
7795 Middle Loup River at Loup City	5,170		1950-56	823		4,220	69	Do.
7800 Middle Loup River at Rockville	5,310	4,220	1956-64	751		10,400	27	Do.
7810 Middle Loup River at Boelus			1953-55	584		4,590	2	Flow affected by upstream diversions for irrigation, return flows from irrigated areas, and diversion to Boelus Canal
7820 South Loup River near Cumro (near Milton)	1,340		1947-53	165		7,200	52	
7825 South Loup River at Ravenna	1,660	740	1941-58;1968-75	192		41,000(est) 17,100	8.6	Flow affected by small upstream diversions for irrigation
7830 Mud Creek near Broken Bow	126		1950-53	1.88		410	0.5	
7835 Mud Creek near Sweetwater	707	52	1947-89	38.2		27,000(est) 5,600	0	Do.
7840 South Loup River at St. Michael	2,350	740	1944-89	237		50,000(est) 27,500	0	Do.
7843 Oak Creek near Loup City	41.9		1953-60;1962-64	1.66(1953-60) .44(1962-64)		655(1953-60) 154(1962-64)	0	Flow affected by storage in Sherman Reservoir since August 1960
7845 Oak Creek near Dannebrog	122		1950-57	8.05		1,880	0	Flow affected by small upstream diversions for irrigation
7848 Turkey Creek near Dannebrog	66.2		1967-70;1979-89	10.1(1967-70) 21.1(1979-89)		2,680(1967-70) 1,790(1979-89)	0.1 2.0	Flow affected by return flow from Farwell Project
7850 Middle Loup River at St. Paul	8,090	4,960	1895-1915;1929-89	1442(1895-1915) 1108(1929-89)		29,100(1929-89)	23	Flow affected by upstream diversions for irrigation and return flows from irrigated areas
7855 North Loup River at Brewster	1,890		1945-51	378		1,600	100	
7860 North Loup River at Taylor	2,280	2,100	1938-89	471		3,210	45	Flow affected by upstream diversions for irrigation and, since April 1, 1939, by diversions to Taylor-Ord Canal
7865 North Loup River at Burwell	2,510		1953-60	505		2,600	80	Do.
7870 Calamus River near Harrop	983		1979-89	248		801	90	Flow affected by upstream diversions for irrigation
7875 Calamus River near Burwell	1,060	950	1941-89	305(1941-85) 264(1986-88)		1,790	13	Flow affected by upstream diversions for irrigation and since 1985 by closure of Calamus Dam. Minimum discharge due to closure of Calamus Dam.
7885 North Loup River at (near) Ord	3,750	3,050	1938; 1953-89	779(1938) 891(1953-89)		2,180(1938) 10,100(1953-89)	250 100	 Do.
7889.88 Mira Creek near North Loup			1980-89	1.98		3,460	0	

TABLE 1f

Summary of recorded discharge at gaging stations on Nebraska streams (continued)

Station name and number	Drainage area[1] (square miles) Total	Drainage area[1] (square miles) Non-contributing	Water years of record	Discharge, in cubic feet per second Average[2]	Median	Instantaneous maximum	Minimum daily	Remarks
7890 North Loup River at Scotia			1937-69	864		37,600	105	Flow affected by upstream diversions for irrigation and by return flows from irrigated lands
7895 Davis Creek near Cotesfield	94		1950-58	5.64		1,720	0	
7900 North Loup River near Cotesfield			1950-56	902			120	Flow affected by upstream diversions for irrigation and return flow from irrigated areas
7905 North Loup River near St. Paul	4,290	3,050	1895-1915;1929-89	1126(1895-1915) 925(1929-89)		36,400(1929-89)	85	Do.
7910 Spring Creek at Cushing	164		1949-53	16		5,350	0	
7915 Cedar River near Spalding	762		1945-53;1958-89	164		4,000	30	Flow affected by small upstream diversions for irrigation
7917.5 Cedar River at Primrose	870		1961-64	208		113	76	Do.
7918 Cedar River at Belgrade	1,060	740	1960-65	227		3,820	64	Flow affected by power development, groundwater withdrawals for irrigation, diversions for irrigations, and return flows from irrigation
7920 Cedar River near Fullerton	1,220	740	1941-89	250		64,700	30	Do.
7930 Loup River near Genoa	14,400	8,750	1929-31;1944-89	2660(1929-31) 678(1944-89)		20,000(1929-31) 129,000(1944-89)	0	Flow greatly affected since 1936 by diversion to Loup River Power Canal
7935 Beaver Creek at Loretto	311	211	1945-53;1980-89	91.7(1945-53) 83.6(1980-89)		4,570(1945-53) 2,300(1980-89)	22 12	Flow affected by upstream diversions for irrigation
7940 Beaver Creek at Genoa	647	237	1941-89	125		21,200	.41	
7945 Loup River at Columbus	15,200	8,970	1895-1915;1934-77	3135(1895-1905) 960(1934-77)		70,000(1895-1915) 119,000(1934-77)	1.8	Flow greatly affected by upstream diversion to Loup River Power Canal
7950 Shell Creek at Newman Grove	122		1950-67	13.2		14,500	0	Flow affected by upstream diversion and groundwater withdrawals for irrigation
7955 Shell Creek near Columbus	270		1948-75;1978-89	44.2		5,970	0.4	Do.
7960 Platte River at North Bend	77,100	13,800	1950-89	4518	40.0	112.000	39	Flow affected greatly by transmountain diversions. storage, reservoirs, power developments, diversions and groundwater withdrawals for irrigation, and return flow from irrigated areas
7969.73 Elkhorn River near Atkinson			1983-89	111		2.500	4.4	Small upstreram diversions for irrigation
7969.78 Holt Creek near Emmet			1979-89	34.8	26.0	562	.1	
7969.85 Elkhorn River at Emmet			1980-82	67.6		740	0	Do.
7975 Elkhorn River at Ewing	1,400	660	1948-89	183	120	7.500	5.2	
7980 South Fork Elkhorn River near Ewing	314	124	1948-53;1961-72; 1978-89	69.5	52.9	5.640	11	
7983 Clearwater Creek near Clearwater	210	80	1962-64;1978-89	433		1,510	4.4	
7985 Elkhorn River at Neligh	2.200	1.000	1931-58:1961-89	306	240	14.100	12	
7988 Elkhorn River at Meadowgrove	2.500	1.000	1961-65	398		9.600	82	
7990 Elkhorn River at Norfolk	2.790	1,000	1946-89	514	418	16.900	33	
7990.8 Willow Creek near Foster	137		1976-89	14.9	9.8	574	1.5	
7991 North Fork Elkhorn River near Pierce	700	30	1961-89	90.0	68.5	15.200	2.7	

TABLE 1g

Summary of recorded discharge at gaging stations on Nebraska streams (continued)

Station name and number	Drainage area[1] (square miles) Total	Non-contributing	Water years of record	Discharge, in cubic feet per second Average[2]	Median	Instantaneous maximum	Minimum daily	Remarks
7992.3 Union Creek at Madison	174		1979-89	39.5		7,630	3.6	
7993.5 Elkhorn River at West Point	5,100	1.000	1973-89	868		28,300	41	
7993.85 Pebble Creek at Scribner	204		1979-89	65.3	47	20,300	.29	
7994.5 Logan Creek at Pender	731		1966-89	160	130	36,900	12	
7995 Logan Creek near Uehling	1,030		1942-89	202	170	25,200	6.1	
8000 Maple Creek near Nickerson	450		1952-89	67.4	53	10,800	0.1	
8005 Elkhorn River at Waterloo	6,900	1.030	1900-03;1912-15: 1929-89	1.217	1.010	100,000	50	Flow affected slightly by upstream diversions for irrigation
8010 Platte River near Ashland	84,200		1929-52:1989	4540(1929-41) 5961(1942-52)		107,000	265	Flow affected by transmountain diversions. storage reservoirs, power developments, diversions and groundwater withdrawals for irrigation, and return flows from irrigated areas
8013 Salt Creek subwatershed 3 near Sprague	4.2		1956-59	1.10		244	.06	
8014 Salt Creek subwatershed 1 near Roca	1.46		1956-60	.272		610	0	Flow affected by upstream detention storage
8015 Salt Creek subwatershed 12 at Roca	1.12		1955-60	.248		528	0	
8025 Salt Creek watershed 34 near Roca	5.72		1955-60	1.74		2,600	0	
8030 Salt Creek at Roca	167		1952-89	47.5		16,700	0.2	Maximum discharge of 67,000 cfs during flood of May 1950.
8034 Antelope Creek at 17th St., Lincoln	12.5		1959-62	4.46		2,800	0	
8034.5 Oak Creek near Raymond	83.6		1964-67	2.28		3,310	.05	
8035 Salt Creek at Lincoln	684		1950-89	234		28,200	21	Flow affected by upstream detention storage
8035.1 Little Salt Creek near Lincoln	43.6		1970-89	15.5	14	8,000	.20	
8035.2 Stevens Creek near Lincoln	47.8		1969-89	18.7	20	12,900	0	
8035.3 Rock Creek near Ceresco	119		1971-89	39.1	31	23,300	.25	
8035.55 Salt Creek at Greenwood	1,051		1953-89	341	290	46,800	14	
8040 Wahoo Creek at Ithaca	271		1949-89	87.1	75.6	77,400	3.3	
8045 Silver Creek at Ithaca	72		1949-58	9.66		21,600		
8050 Salt Creek near Ashland	1,640		1947-67	487		21,600	102	
8055 Platte River at Louisville	85,800	14.800	1954-85	6.592		144,000	131	Flow affected by transmountain diversions. storage reservoirs. power developments, diversions and groundwater withdrawals for irrigation. and return flows from irrigated areas
8065 Weeping Water Creek at Union	241		1951-89	97.2	73	60,300	.1	
8070 Missouri River at Nebraska City	410,000		1930-89	37,000		414,000	1,600	Flow regulated by upstream rewervoirs
8105 Little Nemaha River near Syracuse	218		1952-69	64.8	46	28,600	0	
8109 Brownell Creek subwatershed 1A near Syracuse	.19		1956-69	.049		264	0	

TABLE 1h

Summary of recorded discharge at gaging stations on Nebraska streams (continued)

Station name and number	Drainage area[1] (square miles) Total	Non-contributing	Water years of record	Discharge, in cubic feet per second Average[2]	Median	Instantaneous maximum	Minimum daily	Remarks
8110 Brownell Creek subwatershed 2 near Syracuse	.77		1955-69	.223		720	0	
8115 Little Nemaha River at Auburn	793		1950-89	296	206	164,000	.87	
8135 Missouri River at Rulo	414,900		1949-89	41,430		358,000	4,420	
8140 Turkey Creek near Seneca, Kansas	276		1949-89	128		21,400	0	
8145 North Fork Big Nemaha River at Humboldt	548		1952-89	203	169	59,500	.07	
8150 Big Nemaha River at Falls City	1,340		1945-89	605	530	71,600	3.0	
8155 Muddy Creek at Verdon	186		1953-72	66.3		31,900	1.0	
8215 Arikaree River at Haigler	1,640		1932-80	21.4	18	50,000	0	
8230 North Fork Republican River at Colorado-Nebraska state line	1,360		1931-89	48.1		2,110	0	Flow affected by upstream diversions for irrigation
8235 Buffalo Creek near Haigler	260		1941-89	7.29		140	0	Flow affected by upstream diversion to irrigate 880 acres
8240 Rock Creek at Parks	20		1941-89	13.6		493	2.6	Flow affected by upstream diversion to irrigate 215 acres and by upstream regulation by State Fish Hatchery
8245 Republican River at Benkelman	4,830	3,600	1895;1903-06; 1947-89	84.6		6,040	0	Flow affected by upstream diversions for irrigation
8275 South Fork Republican River near Benkelman	2,740	550	1895;1903-06; 1938-89	47.0		19,600	0	Flow affected by upstream storage in Bonny Reservoir and diversions for irrigation
8280 Republican River at Max	7,580		1929-45	186		190,000	0	Flow affected by many upstream diversions for irrigation
8284.9 Muddy Creek at Stratton	157	71	1978	.70		10	0	
8285 Republican River at Stratton	8,450	4,650	1951-89	122	108	26,800	0	Do.
8295 Republican River at Trenton	8,620	4,680	1947-89	256(1947-52) 52.1(1954-89)		16,800	0	Flow affected storage in Bonny and Swanson reservoirs and by upstream diversions for irrigation
8305 Frenchman Creek near Champion	480		1933-40	26.6		863	8	Flow affected by upstream diversions for irrigation and into Champion Lake
8310 Frenchman Creek below Champion	519		1935-56	42.5		2,850	5	Flow affected by upstream diversions for irrigation and by regulation of low flow by upstream power plant
8315 Frenchman Creek near Imperial	880	160	1941-89	58.3		2,340	4.8	
8325 Frenchman Creek near Enders	950	160	1947-89	56.4		763	0	Flow regulated by releases from Enders Reservoir since 1950
8335 Frenchman Creek near Hamlet	1,090		1929-56	101(1929-49) 83.9(1950-56)		7,000	19	Flow regulated by upstream irrigation developments and, since 1945, by releases from Enders Reservoir
8340 Frenchman Creek at Palisade	1,110	160	1894-96;1951-89	78.7		5,560	11	Do.
8345 Stinking Water Creek near Wauneta	1,330		1941-50	24.5		626		Flow affected by upstream diversions for irrigation
8350 Stinking Water Creek near Palisade	1,500	1,120	1950-89	38.4		3,030	6.0	Do.

Summary of recorded discharge at gaging stations on Nebraska streams (continued)

Station name and number	Drainage area[1] (square miles) Total	Drainage area[1] (square miles) Non-contributing	Water years of record	Discharge, in cubic feet per second: Average[2]	Median	Instantaneous maximum	Minimum daily	Remarks
8355 Frenchman Creek at Culbertson	2,770	1,300	1931-89	97.1		15,000	0	Flow affected by upstream irrigation developments and, since 1950, by diversion to Culbertson Canal
8360 Blackwood Creek near Culbertson	320	50	1947-86	5.85	5.3	1,650	0	Flow affected by beaver dams, upstream irrigation development, return flow from irrigated land, and waste from Culbertson Canal
8365 Driftwood Creek near McCook	360	10	1947-89	10.2	8.3	4,740	0	Flow affected by upstream irrigation developments and waste from Meeker-Driftwood Canal
8370 Republican River at McCook	12,310	6,050	1931;1954-89	169		5,890	0	Maximum flood discharge in May 1935 about 245,000 cfs. Flow affected by upstream storage in reservoirs and irrigation developments
8373 Red Willow Creek above Hugh Butler Lake	600	400	1961-89	26.8		4,020	3.2	Flow affected by upstream irrigation development
8375 Red Willow Creek near McCook	740	420	1941-47;1961-89	33.7(1941-47) 20.1(1961-89)		30,000	.60	Flow affected by upstream irrigation development and, since 1961, by storage in Hugh Butler Lake
8380 Red Willow Creek near Red Willow	830	420	1940-89	42.0(1940-61) 14.0(1963-89)		30,000(1940-61) 1,270(1962-89)	2.0 .26	
8385 Dry Creek near Bartley	5.24		1956	0		0	0	
8390 Medicine Creek at Maywood	207	125	1952-58	24.4		2,120	7.6	Flow affected by upstream irrigation development
8395 Brushy Creek near Maywood	130	58	1952-58	1.84		5,250	0	
8400 Fox Creek at Curtis	74		1952-58;1978-89	6.55		3,340	.71	
8405 Dry Creek near Curtis	21.7		1952-58	.50		1,350	0	Maximum discharge of 4430 cfs in 1951 (partial record)
8410 Medicine Creek above Harry Strunk Lake	770		1951-89	63.3	57	11,600	9.1	Flow affected by upstream irrigation
8415 Mitchell Creek above Harry Strunk Lake	52		1957-74	2.30	1.20	5,230	0	
8425 Medicine Creek below Harry Strunk Lake	880		1949-89	59.3		1,300	.06	Flow regulated by Harry Strunk Lake since 1950
8430 Medicine Creek at (near) Cambridge	1,070	390	1937-43;1945-56	90.1(1937-49) 64.9(1951-56)		120,000	.05	Flow regulated by Harry Strunk Lake since 1950
8435 Republican River at Cambridge	14,520	6,710	1946-89	257(1951-89)		160,000	.07	Flow affected by upstream reservoirs and upstream irrigation developments
8440 Muddy Creek at Arapahoe	246		1951-72;1978-89	14.6	11	10,800	0	Flow affected by upstream irrigation developments
8442.1 Turkey Creek at Edison	74.9		1978-89	7.16		795	.74	Do.
8445 Republican River near Orleans	15,640	6,730	1948-89	281		40,600	0	Flow affected by upstream reservoirs and irrigation developments
8452 Sappa Creek near Beaver City	1,510	160	1937-72	38.3	26	9,500	0	Flow affected by upstream diversions for irrigation
8470 Beaver Creek near Beaver City	1,950	300	1937-89	21.4	12	9,510	0	
8475 Sappa Creek near Stamford	3,740	460	1946-89	50.7	20	43,400	0	Do.
8485 Prairie Dog Creek near Woodruff, Kans.	1,007		1929-32;1945-89	30.8		15,000	0	Flow affected by upstream storage and irrigation developments
8495 Republican River below Harlan County Reservoir	20,760	7,210	1953-89	238		4,320	1.5	Flow regulated by upstream reservoirs, principally by releases from Harlan County Lake

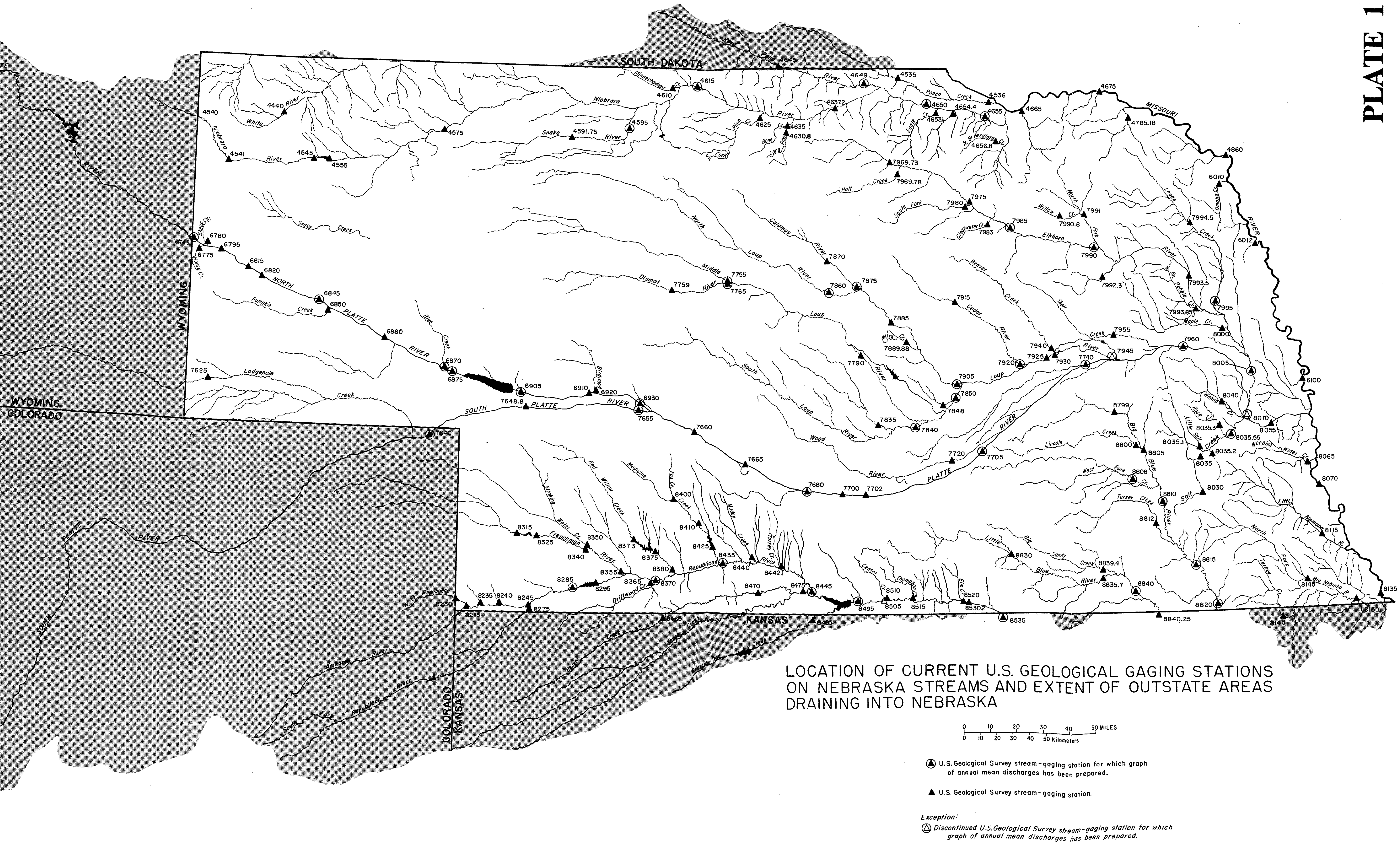
TABLE 1j

Summary of recorded discharge at gaging stations on Nebraska streams (continued)

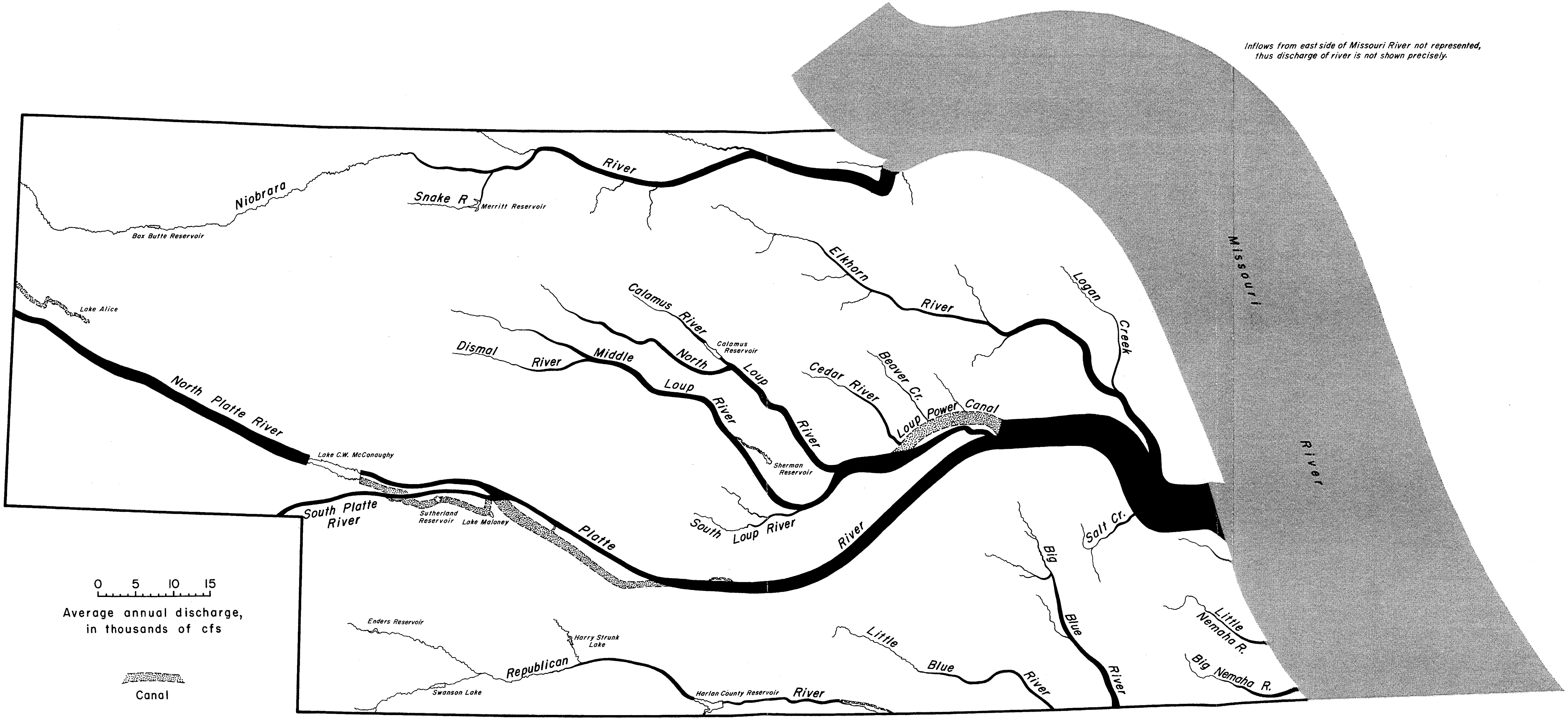
Station name and number	Drainage area[1] (square miles) Total	Drainage area[1] (square miles) Noncontributing	Water years of record	Discharge, in cubic feet per second Average[2]	Discharge, in cubic feet per second Median	Discharge, in cubic feet per second Instantaneous maximum	Discharge, in cubic feet per second Minimum daily	Remarks
8500 Turkey Creek at Naponee	129		1948-53	15.5		1,920	2.1	
8502 Cottonwood Creek near Bloomington	15.6		1949-56	5.30		1,100	2.4	
8505 Republican River near Bloomington	21,020		1929-57	730(1929-52) 155(1953-57)		260,000	6.8	Flow affected by upstream irrigation developments and since 1952 largely regulated by releases from Harlan County Lake
8510 Center Creek at Franklin	177	151	1949-56;1971-75; 1978-89	8.07		3,150	0	Flow affected slightly by upstream diversions for irrigation
8515 Thompson Creek at Riverton	279		1948-56;1968-75; 1978-89	31.0		12,200	8.1	Flow affected by upstream irrigation development
8520 Elm Creek at Amboy	39.2		1949-53;1978-89	21.3		7,800	6.7	Do.
8530 Republican River at (near) Guiderock	22,090	7,490	1951-89	314		29,200	.1	Flow affected by upstream irrigation developments and regulations of upstream reservoirs
8535 Republican River near Hardy	22,401	7,500	1914,1933-52; 1958-89	882(1914,1933-52) 364(1958-89)		225,000	0	
8799 Big Blue River near Surprise	345		1965-89	28.0	25	10,700	0	
8800 Lincoln Creek near Seward	446		1954-73;1975-89	52.6		10,100	1.3	Flow affected by small upstream diversions for irrigation
8805 Big Blue River at Seward	1,099		1954-89	132		15,300	0	Flow affected by upstream irrigation developments
8808 West Fork Big Blue River near Dorchester	1,206		1959-89	184		11,800	12	Do.
8810 Big Blue River near Crete	2,716		1954-89	397		27,600	6.0	Do.
8812 Turkey Creek near Wilbur	460		1960-89	95.8	64	33,000	0	Do.
8815 Big Blue River at Beatrice	3,900	70	1911-15;1975-89	766	626	55,100	20	Do.
8820 Big Blue River at Barneston	4,447	77	1933-89	842		57,700	1	Flow affected by upstream irrigation development and regulation by dam
8829 Little Blue River below Pawnee Creek, near Pauline	881		1963-68	129		17,800	15	
8830 Little Blue River near Deweese	979		1954-72;1975-89	147	130	25,100	3.2	Flow affected by upstream irrigation developments
8835 Little Blue River at Angus			1951-52			18,500	59	
8835.7 Little Blue River near Alexandria	1,557		1960-72;1975-89	248		25,600	2.9	Do.
8839.4 Big Sandy Creek at Alexandria	607		1980-89	111	89	21,900	16	Do.
8840 Little Blue River near Fairbury	2,350		1909-15;1929-89	381		41,900	14	Do.
8840.25 Little Blue River at Hollenburg, Kans	2,752		1975-90	434		36,600	39	Do.

1. Drainage areas differ in accuracy. Values were obtained by planimetering topographic maps and are most nearly accurate for streams whose flow is derived wholly or almost wholly from overland runoff. The term "Noncontributing" indicates areas producing negligible overland runoff.
2. Multiply by 724 to obtain acre-feet per 365-day year.
3. Average only 45.6 if discharge in water year 1962 is excluded.

PLATE 1

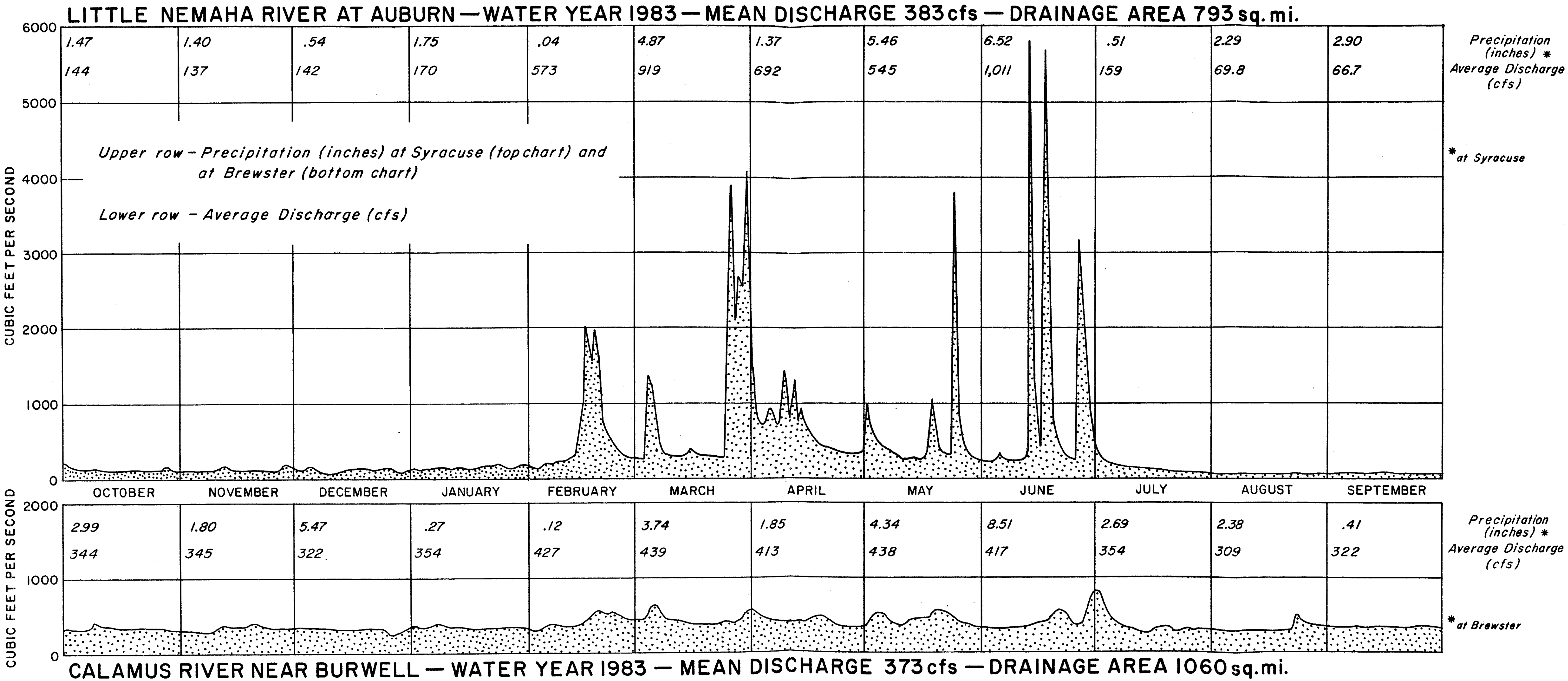


LOCATION OF CURRENT U.S. GEOLOGICAL GAGING STATIONS ON NEBRASKA STREAMS AND EXTENT OF OUTSTATE AREAS DRAINING INTO NEBRASKA



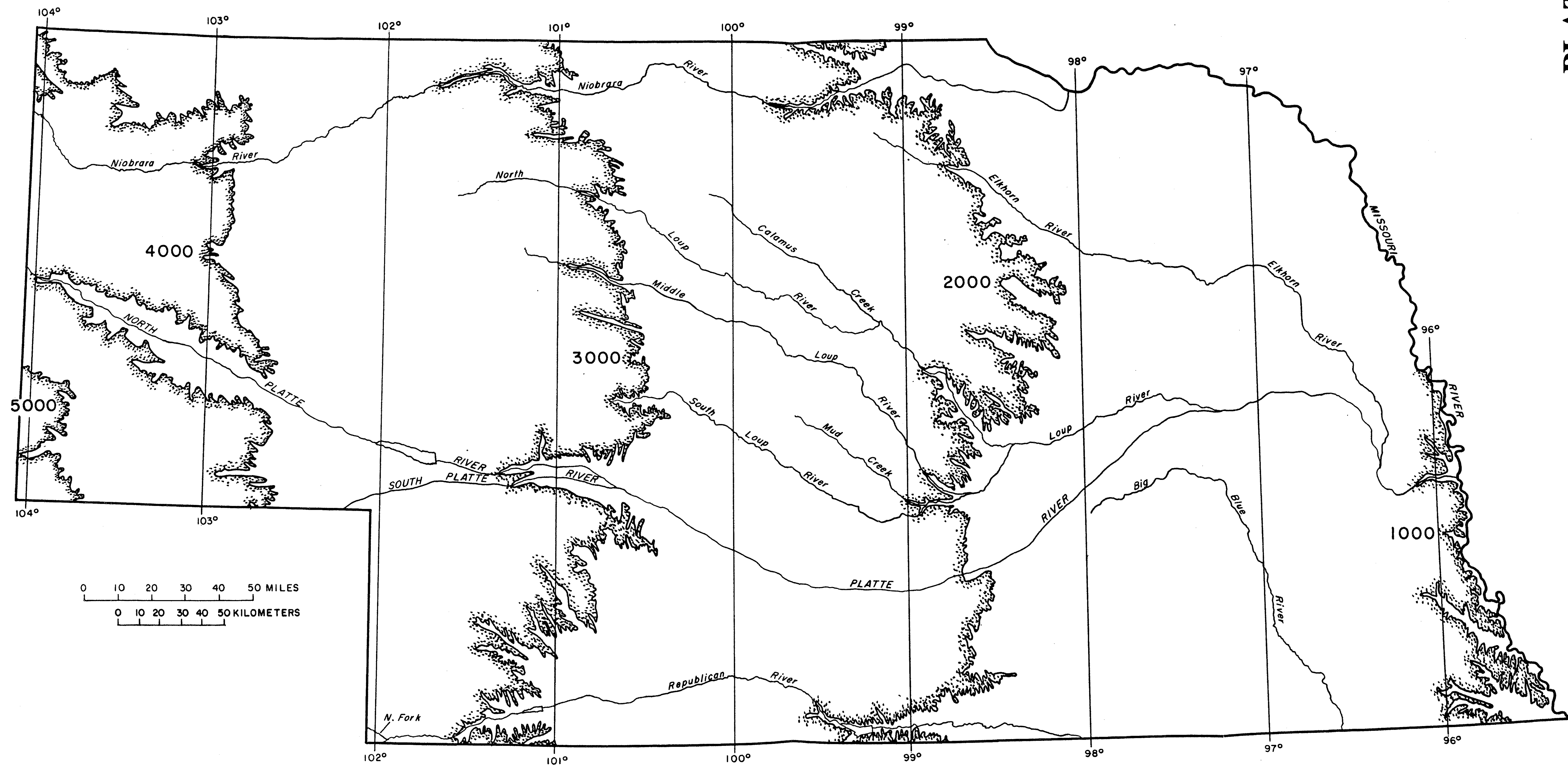
AVERAGE ANNUAL DISCHARGE OF NEBRASKA'S RIVERS

PLATE 3



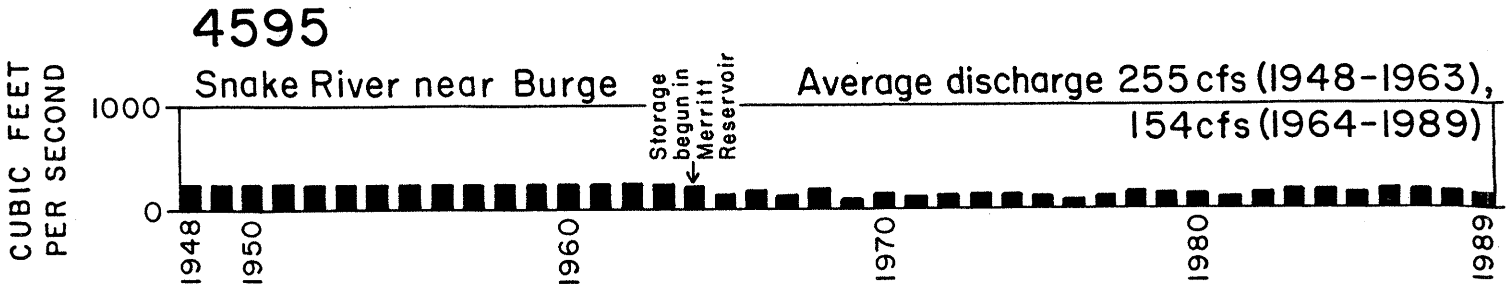
DAILY DISCHARGE OF THE LITTLE NEMAHA RIVER AT AUBURN AND THE CALAMUS RIVER AT BURWELL, WATER YEAR 1983

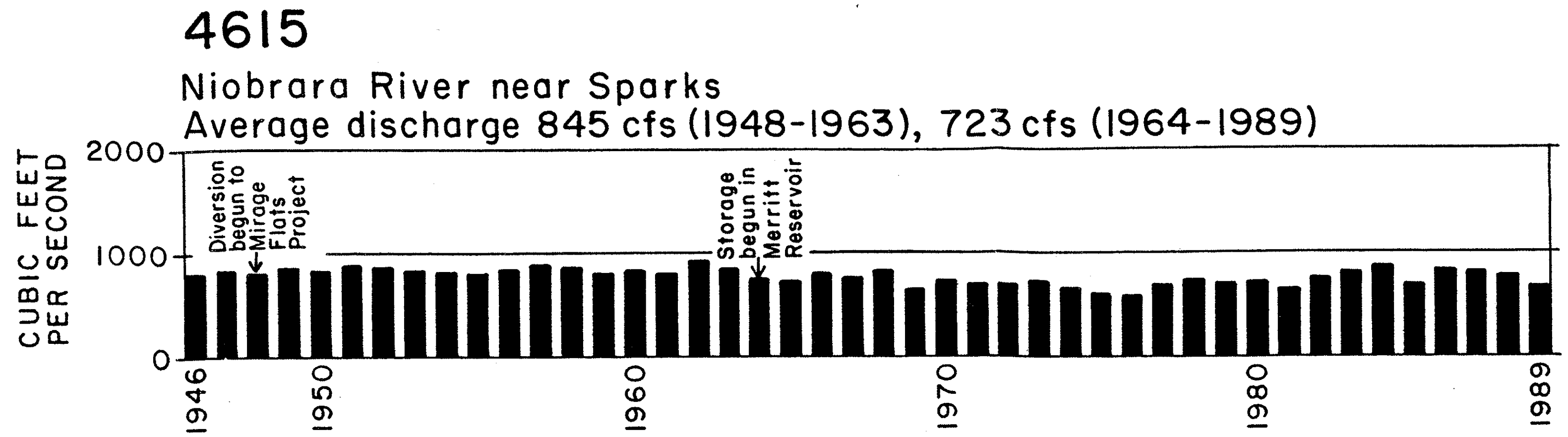
PLATE 4

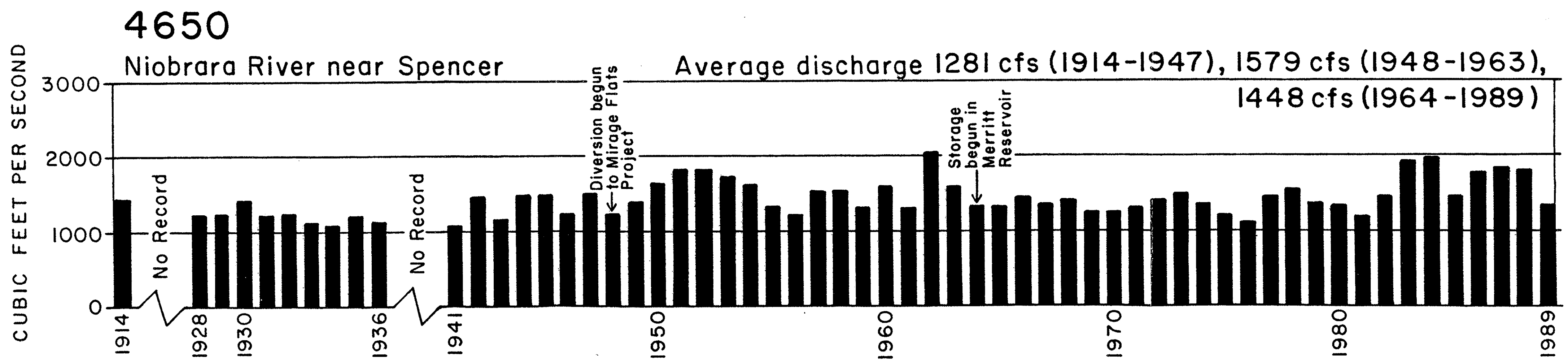


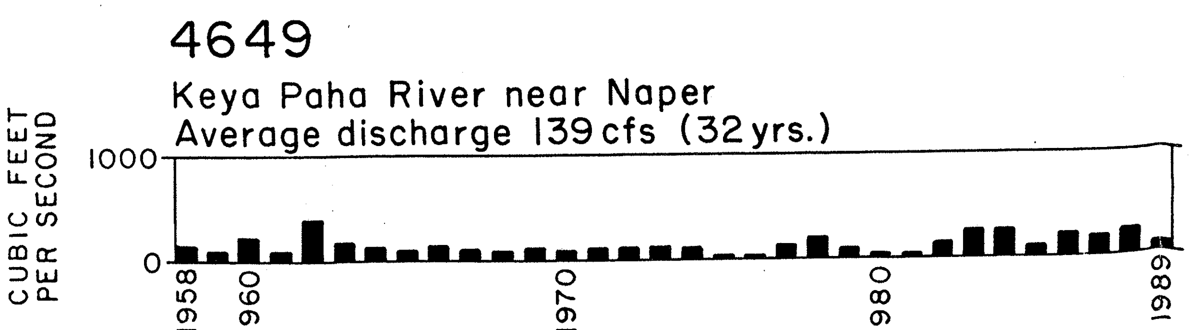
RELATION OF NEBRASKA'S PRINCIPAL STREAMS TO 1000-FOOT TOPOGRAPHIC CONTOURS AND 1-DEGREE LINES OF LONGITUDE

PLATE 5


4595
Snake River near Burge
Average discharge 255 cfs (1948-1963), 154cfs (1964-1989)
Storage begun in Merritt Reservoir
CUBIC FEET PER SECOND
1000
0
1948
1950
1960
1970
1980
1989


4615
Niobrara River near Sparks
Average discharge 845 cfs (1948-1963), 723 cfs (1964-1989)
Diversion begun to Mirage Flats Project
Storage begun in Merritt Reservoir
CUBIC FEET PER SECOND
2000
1000
0
1946
1950
1960
1970
1980
1989


4650
Niobrara River near Spencer
Average discharge 1281 cfs (1914-1947), 1579 cfs (1948-1963), 1448 cfs (1964-1989)
Diversion begun to Mirage Flats Project
Storage begun in Merritt Reservoir
No Record
No Record
CUBIC FEET PER SECOND
3000
2000
1000
0
1914
1928
1930
1936
1941
1950
1960
1970
1980
1989


4649
Keya Paha River near Naper
Average discharge 139 cfs (32 yrs.)
CUBIC FEET PER SECOND
1000
0
1958
1960
1970
1980
1989

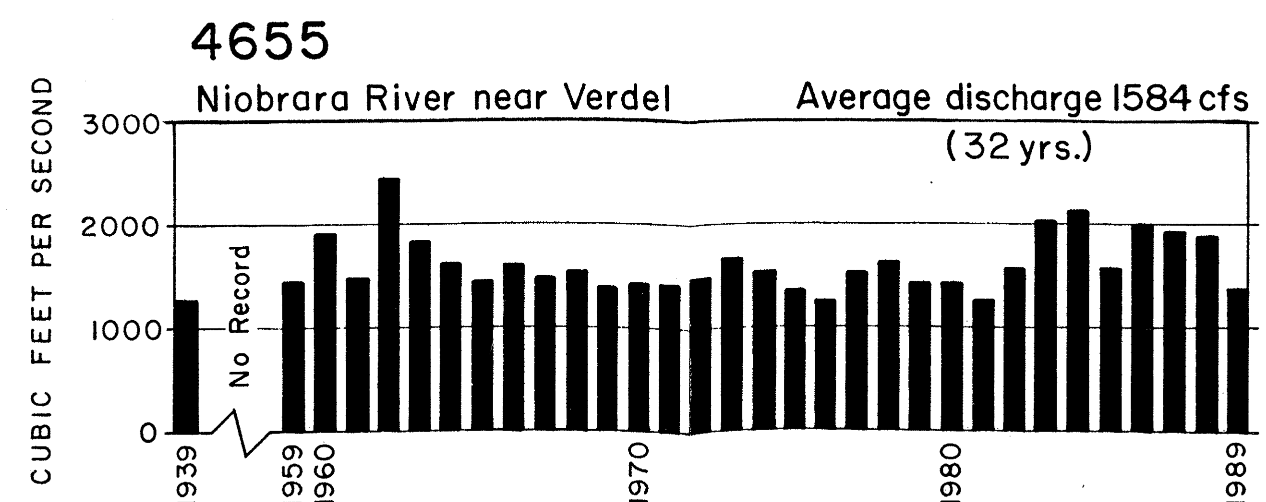
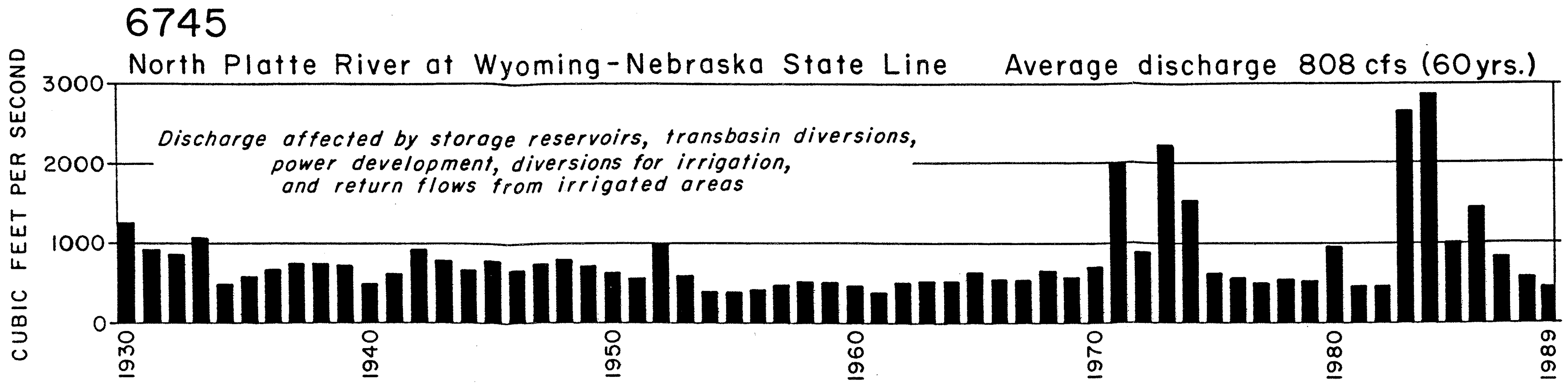
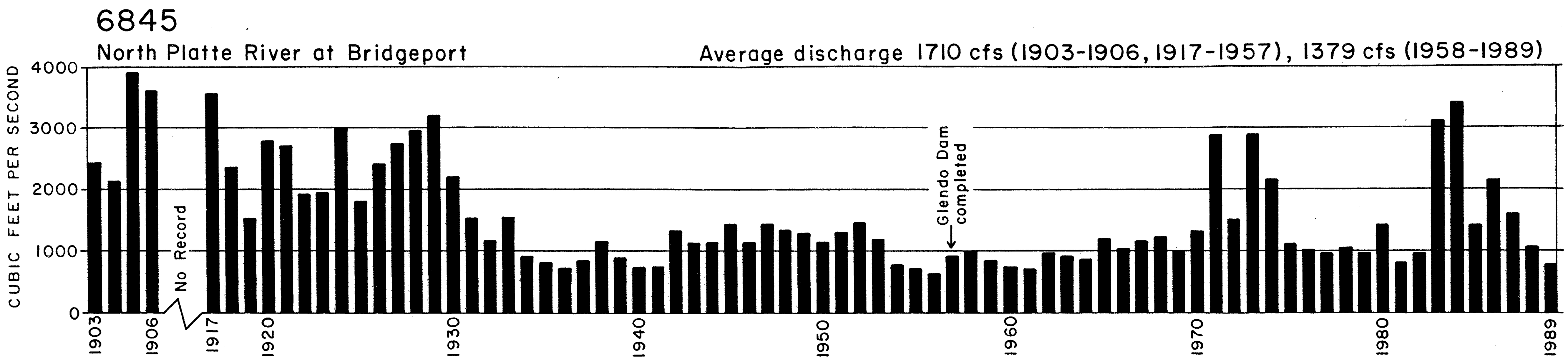

4655
Niobrara River near Verdel
Average discharge 1584 cfs (32 yrs.)
No Record
CUBIC FEET PER SECOND
3000
2000
1000
0
1939
1959
1960
1970
1980
1989

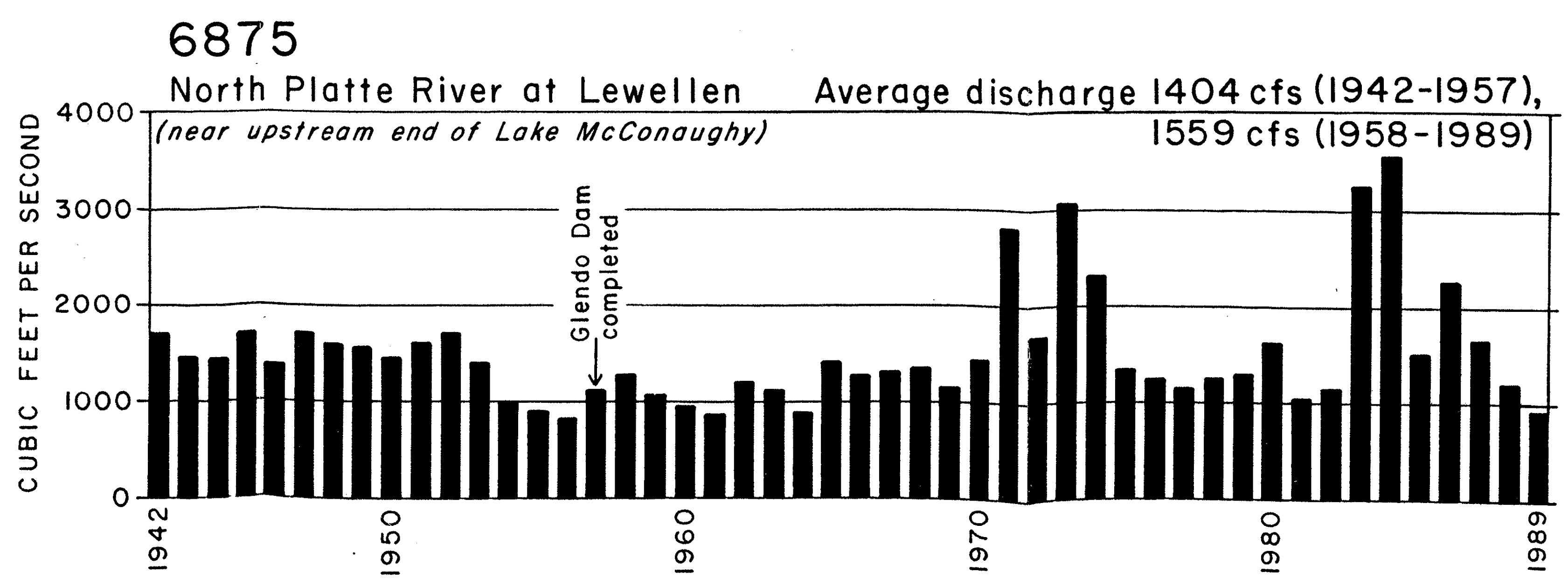
PLATE 6



6745
North Platte River at Wyoming-Nebraska State Line
Average discharge 808 cfs (60 yrs.)
Discharge affected by storage reservoirs, transbasin diversions, power development, diversions for irrigation, and return flows from irrigated areas
CUBIC FEET PER SECOND
0
1000
2000
3000
1930
1940
1950
1960
1970
1980
1989



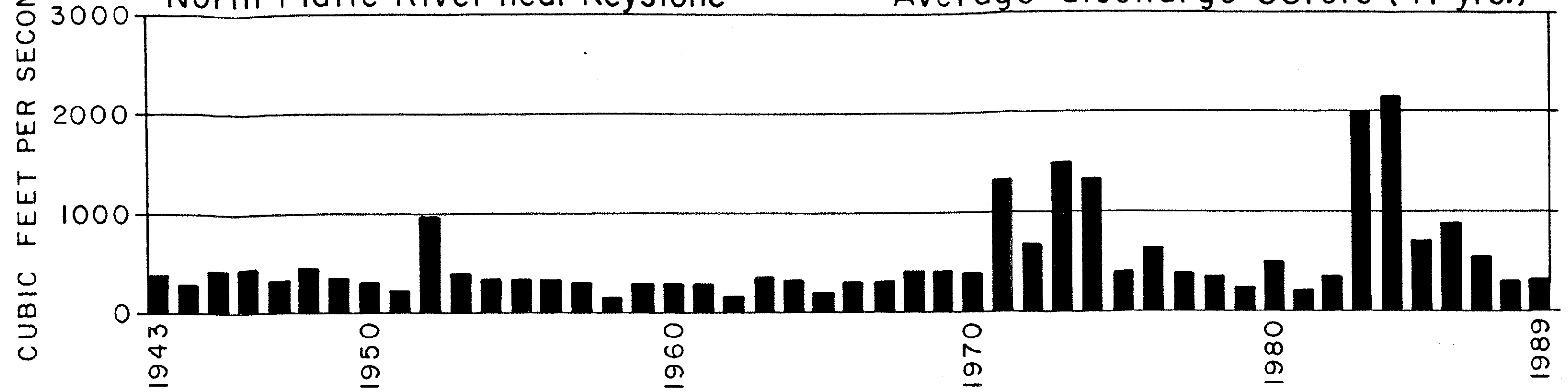
6845
North Platte River at Bridgeport
Average discharge 1710 cfs (1903-1906, 1917-1957), 1379 cfs (1958-1989)
CUBIC FEET PER SECOND
0
1000
2000
3000
4000
No Record
Glendo Dam completed
1903
1906
1917
1920
1930
1940
1950
1960
1970
1980
1989



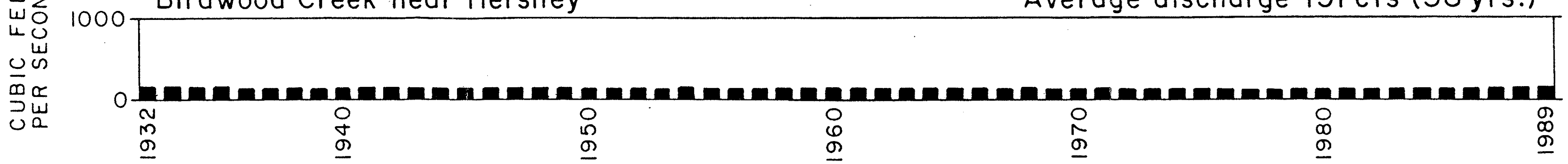
6875
North Platte River at Lewellen
(near upstream end of Lake McConaughy)
Average discharge 1404 cfs (1942-1957), 1559 cfs (1958-1989)
CUBIC FEET PER SECOND
0
1000
2000
3000
4000
Glendo Dam completed
1942
1950
1960
1970
1980
1989

PLATE 7

6905
North Platte River near Keystone — Average discharge 531cfs (47 yrs.)



6920
Birdwood Creek near Hershey — Average discharge 151 cfs (58 yrs.)



6930
North Platte River at North Platte — Average discharge 2717 cfs (1896-1940), 759 cfs (1941-1989)

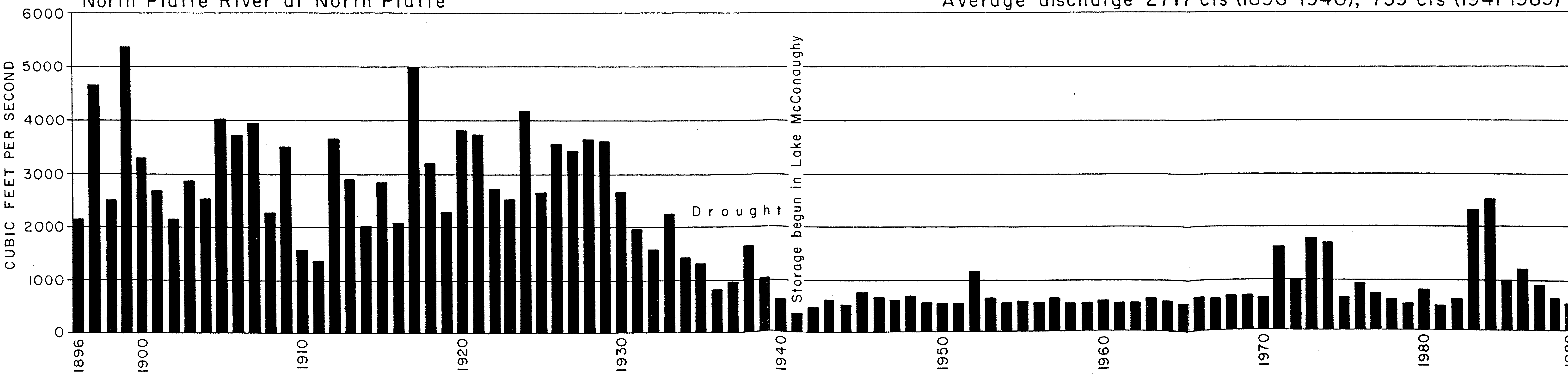
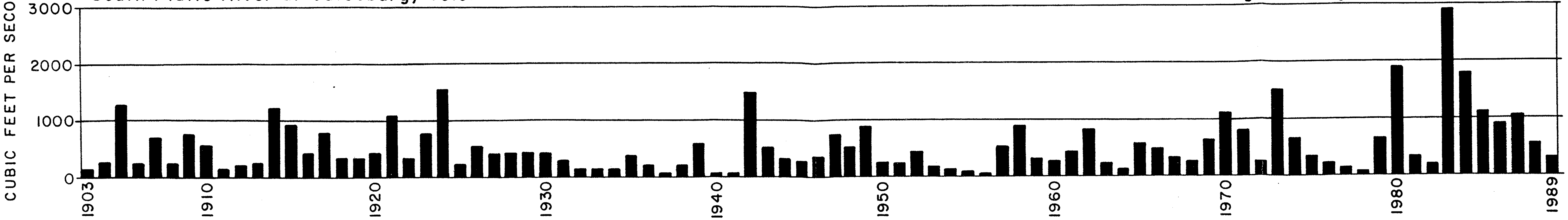


PLATE 8

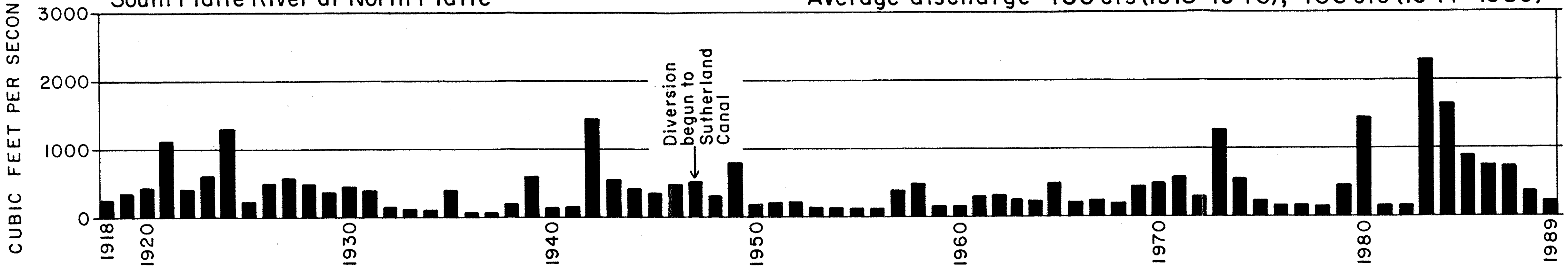
7640

South Platte River at Julesburg, Colo. — Average discharge 546 cfs (87 yrs.)



7655

South Platte River at North Platte — Average discharge 435 cfs (1918-1946), 453 cfs (1947-1989)



7660

Platte River at Brady — Average discharge 803 cfs (51 yrs.)

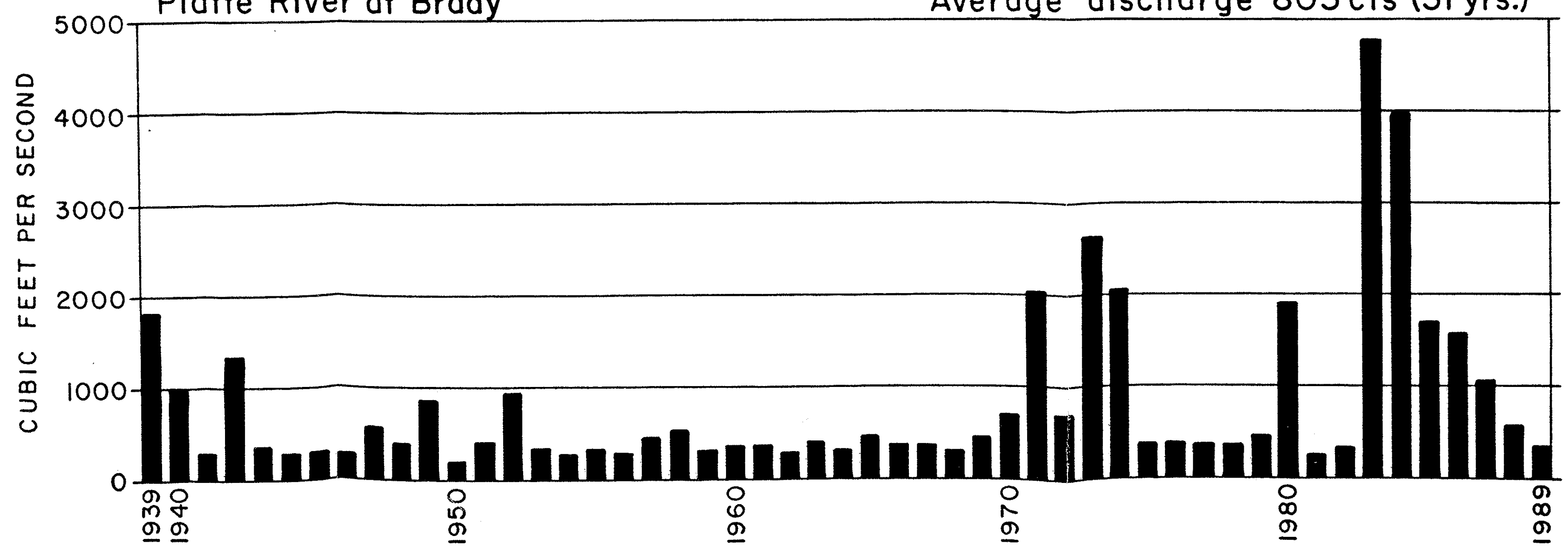
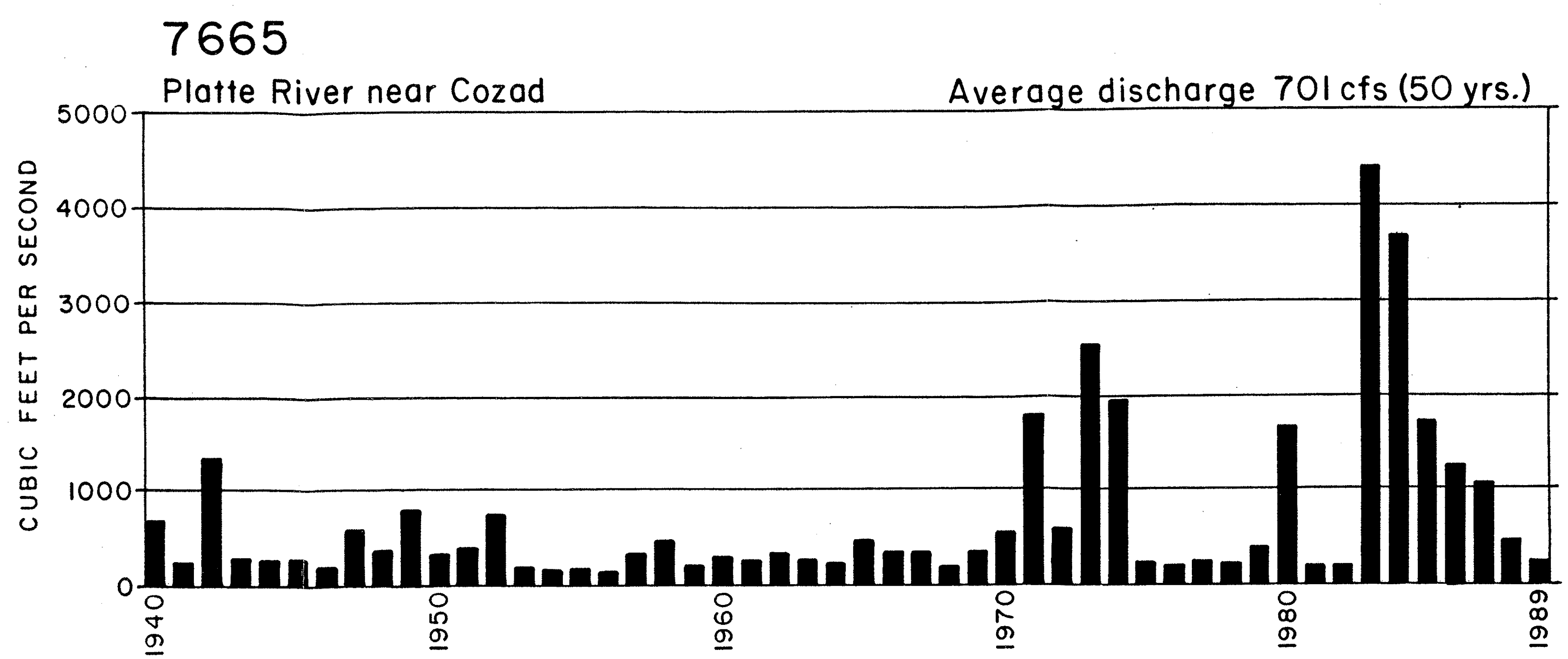


PLATE 9


7665
Platte River near Cozad
Average discharge 701 cfs (50 yrs.)
CUBIC FEET PER SECOND
5000
4000
3000
2000
1000
0
1940
1950
1960
1970
1980
1989

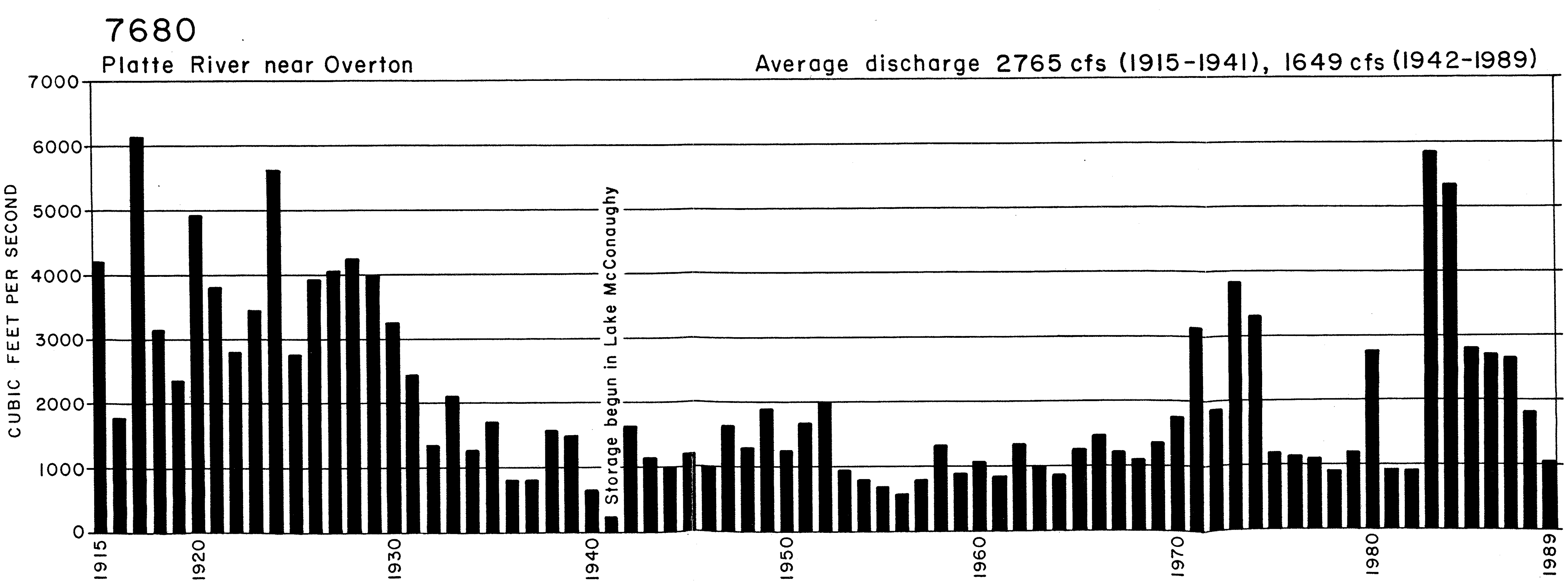
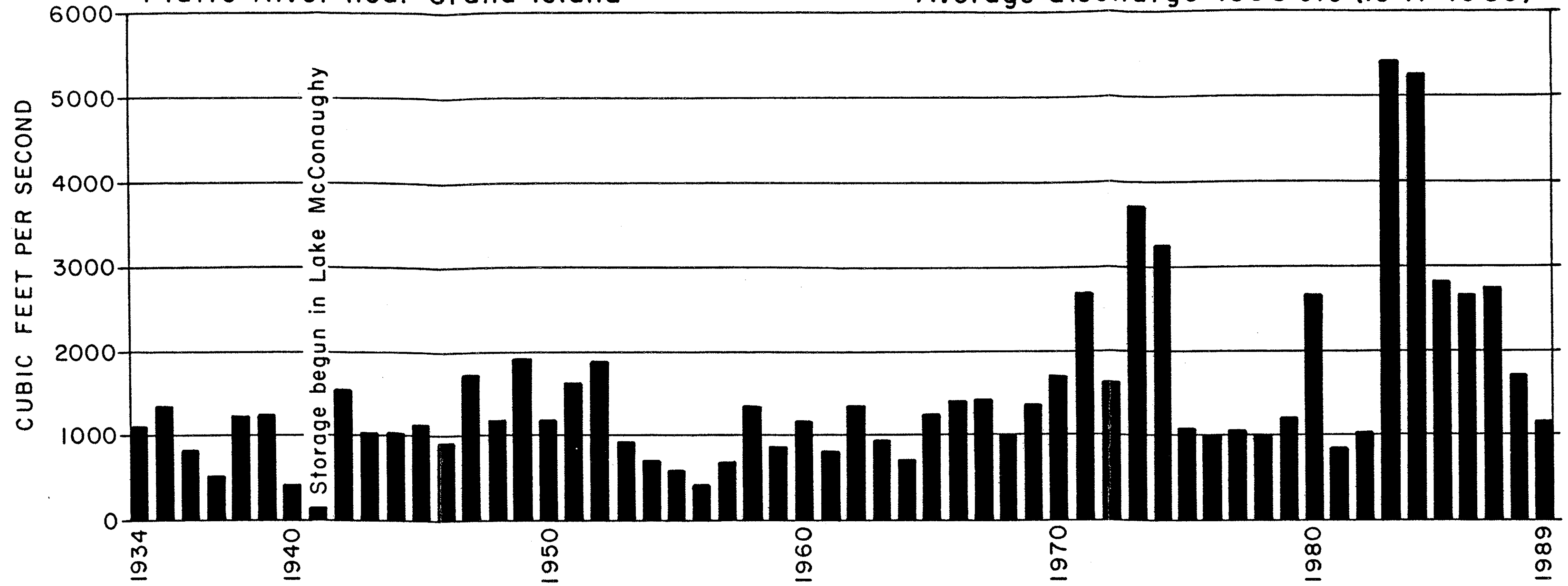

7680
Platte River near Overton
Average discharge 2765 cfs (1915-1941), 1649 cfs (1942-1989)
CUBIC FEET PER SECOND
7000
6000
5000
4000
3000
2000
1000
0
Storage begun in Lake McConaughy
1915
1920
1930
1940
1950
1960
1970
1980
1989

PLATE 10

7705

Platte River near Grand Island — Average discharge 1598 cfs (1941-1989)



7740

Platte River near Duncan — Average discharge 2600 cfs (1901-1909, 1913-1915, 1929-1940), 1754 cfs (1941-1989)

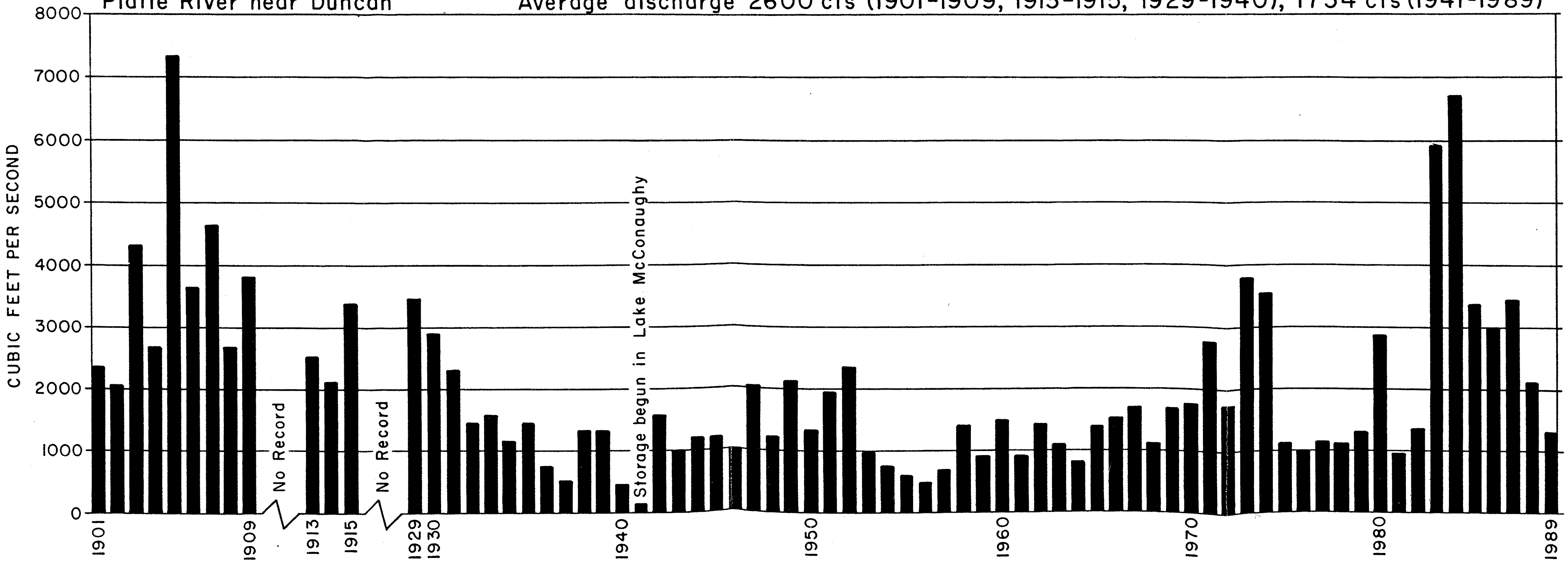
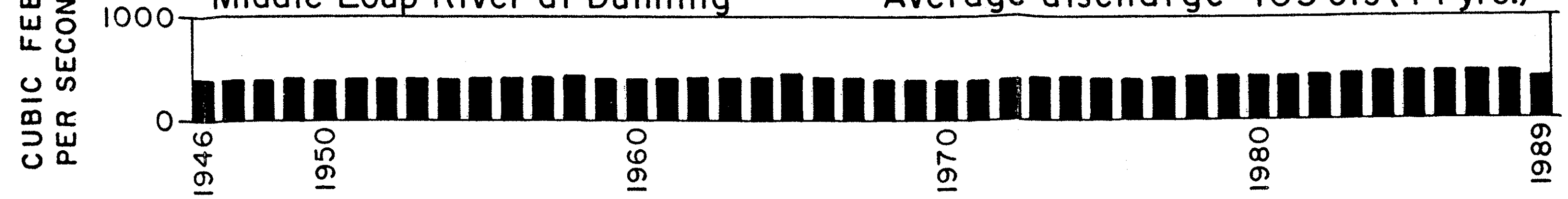


PLATE 11

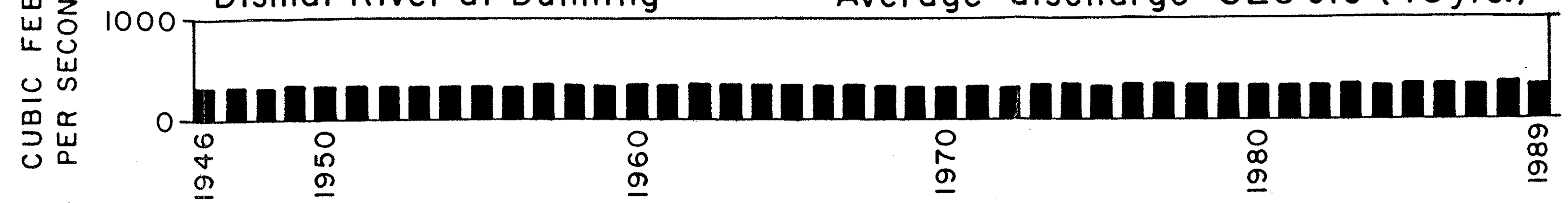
7755

Middle Loup River at Dunning — Average discharge 409 cfs (44 yrs.)



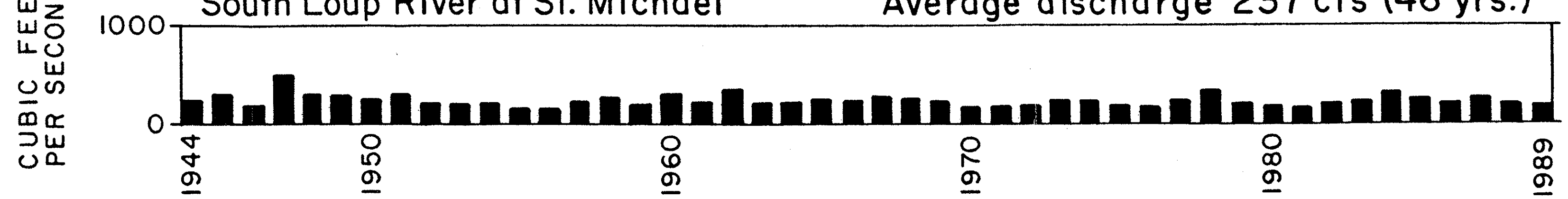
7765

Dismal River at Dunning — Average discharge 326 cfs (43 yrs.)



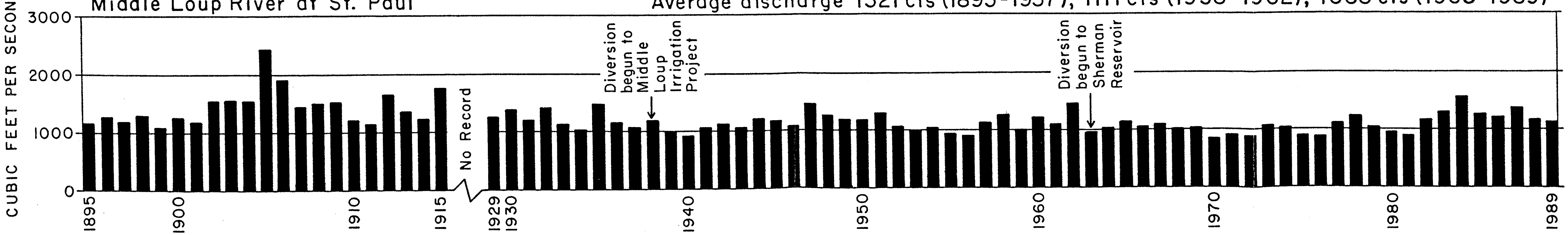
7840

South Loup River at St. Michael — Average discharge 237 cfs (46 yrs.)



7850

Middle Loup River at St. Paul — Average discharge 1321 cfs (1895-1937), 1111 cfs (1938-1962), 1068 cfs (1963-1989)



7860

North Loup River at Taylor — Average discharge 471 cfs (52 yrs.)

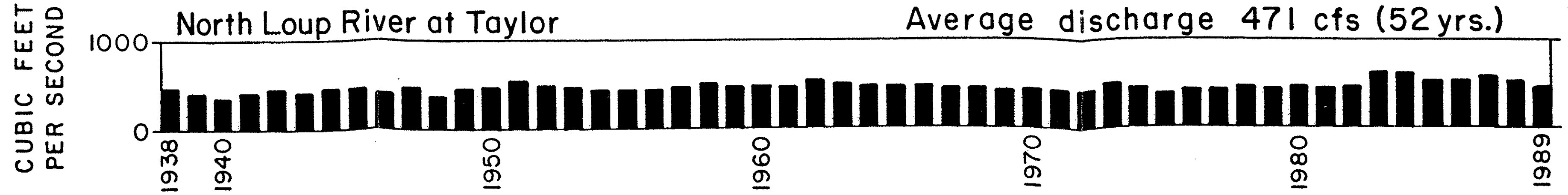
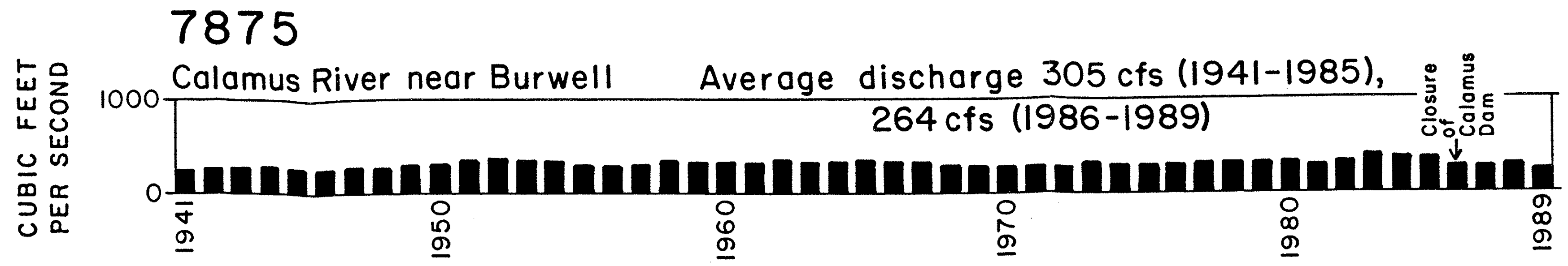
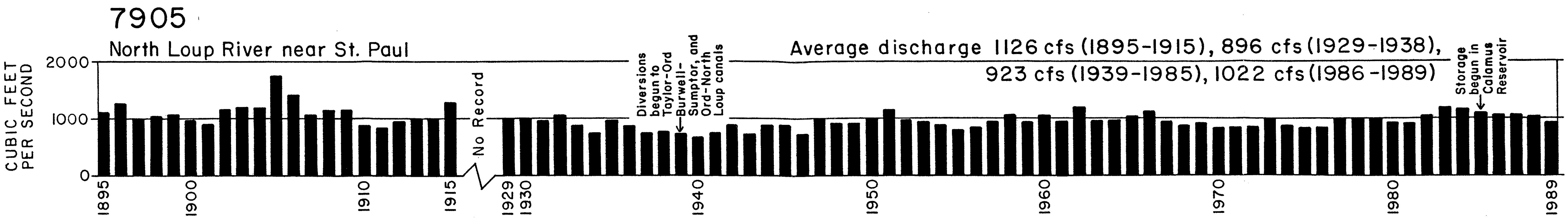


PLATE 12


7875
Calamus River near Burwell
Average discharge 305 cfs (1941-1985), 264 cfs (1986-1989)
Closure of Calamus Dam
CUBIC FEET PER SECOND
1000
0
1941
1950
1960
1970
1980
1989


7905
North Loup River near St. Paul
Average discharge 1126 cfs (1895-1915), 896 cfs (1929-1938), 923 cfs (1939-1985), 1022 cfs (1986-1989)
Diversions begun to Taylor-Ord Burwell-Sumptor, and Ord-North Loup canals
Storage begun in Calamus Reservoir
No Record
CUBIC FEET PER SECOND
2000
1000
0
1895
1900
1910
1915
1929
1930
1940
1950
1960
1970
1980
1989


7920
Cedar River near Fullerton
Average discharge 250 cfs (49 yrs.)
CUBIC FEET PER SECOND
1000
0
1941
1950
1960
1970
1980
1989

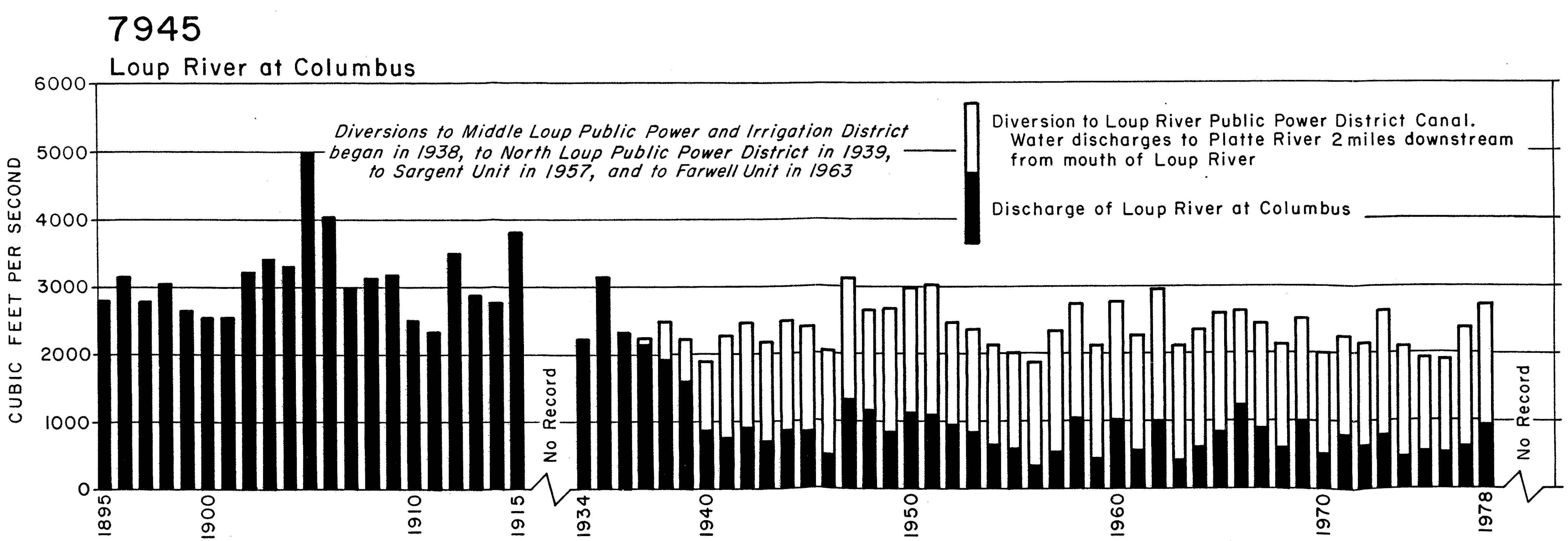
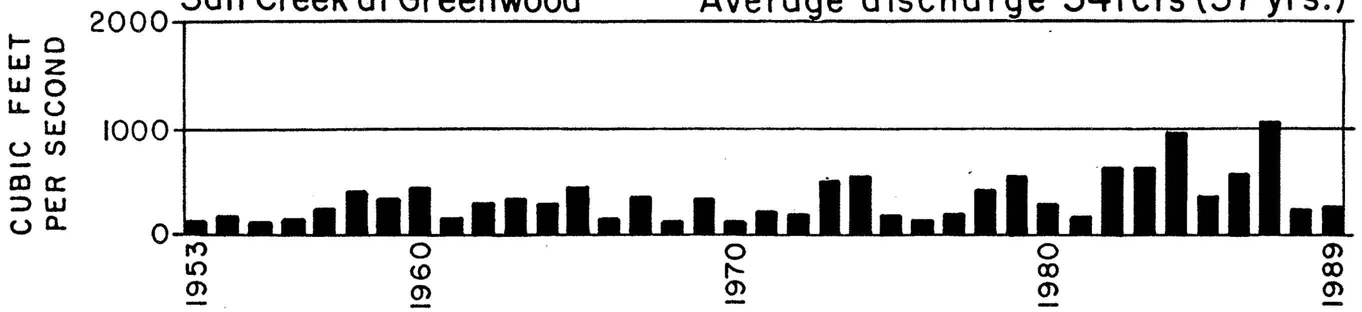

7945
Loup River at Columbus
Diversions to Middle Loup Public Power and Irrigation District began in 1938, to North Loup Public Power District in 1939, to Sargent Unit in 1957, and to Farwell Unit in 1963
Diversion to Loup River Public Power District Canal. Water discharges to Platte River 2 miles downstream from mouth of Loup River
Discharge of Loup River at Columbus
No Record
No Record
CUBIC FEET PER SECOND
6000
5000
4000
3000
2000
1000
0
1895
1900
1910
1915
1934
1940
1950
1960
1970
1978

PLATE 13

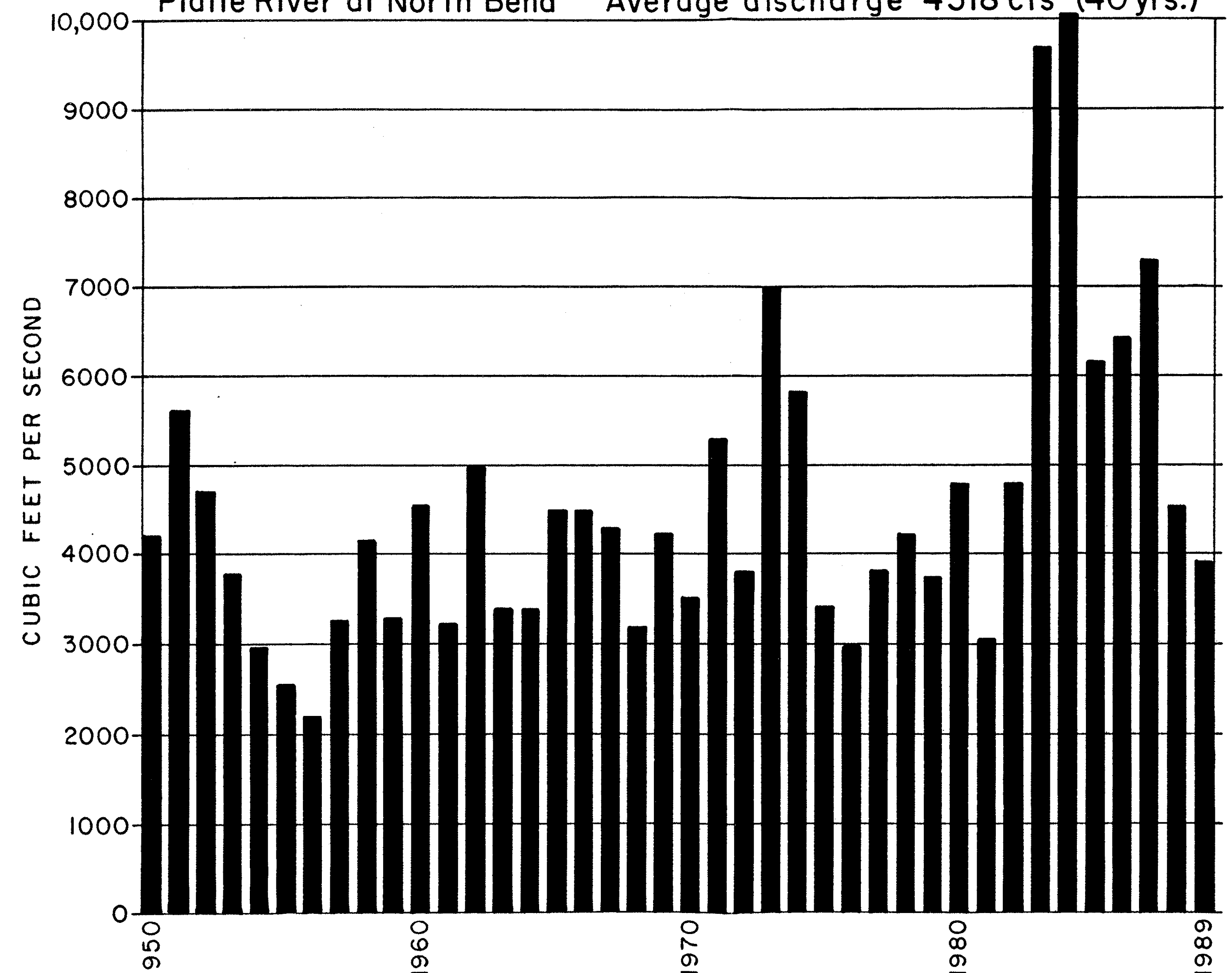
8035.55

Salt Creek at Greenwood Average discharge 341 cfs (37 yrs.)



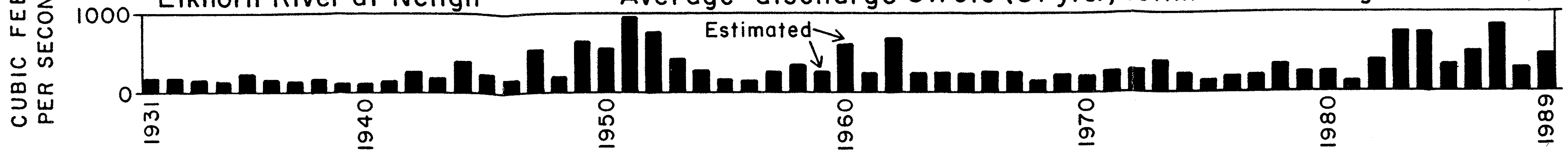
7960

Platte River at North Bend Average discharge 4518 cfs (40 yrs.)



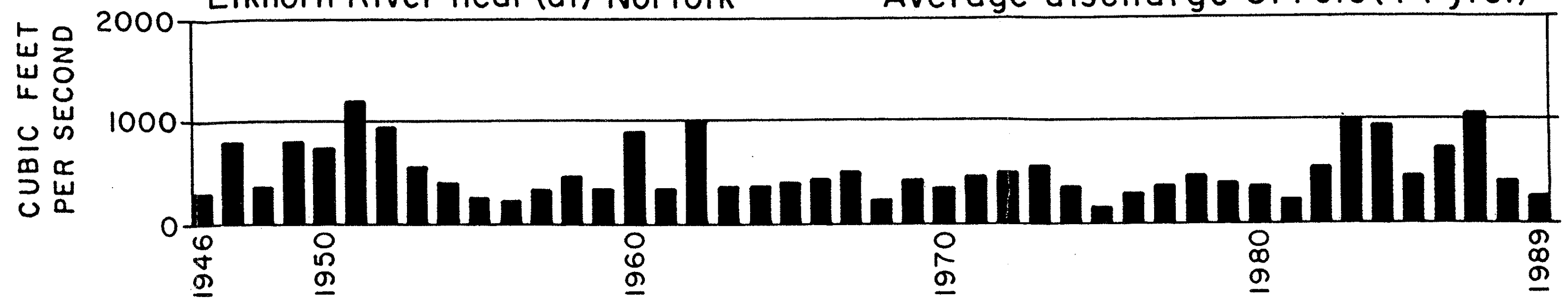
7985

Elkhorn River at Neligh — Average discharge 311 cfs (57 yrs., estimated discharges excluded)



7990

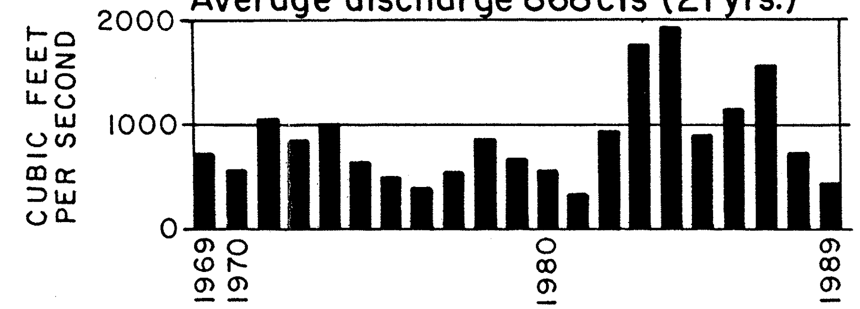
Elkhorn River near (at) Norfolk — Average discharge 514 cfs (44 yrs.)



7993.5

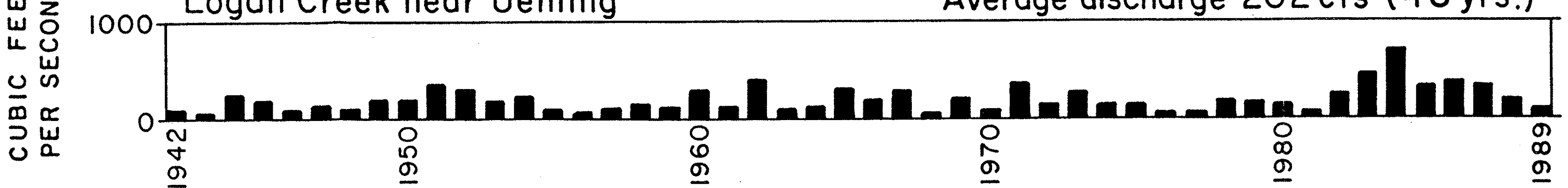
Elkhorn River at West Point

Average discharge 868 cfs (21 yrs.)



7995

Logan Creek near Uehling — Average discharge 202 cfs (48 yrs.)



8005

Elkhorn River at Waterloo — Average discharge 1217 cfs (69 yrs.)

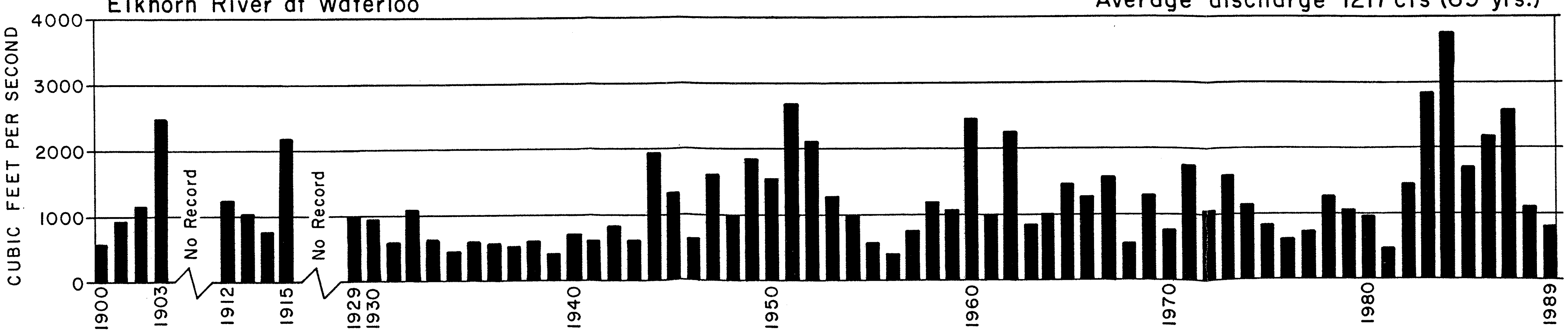
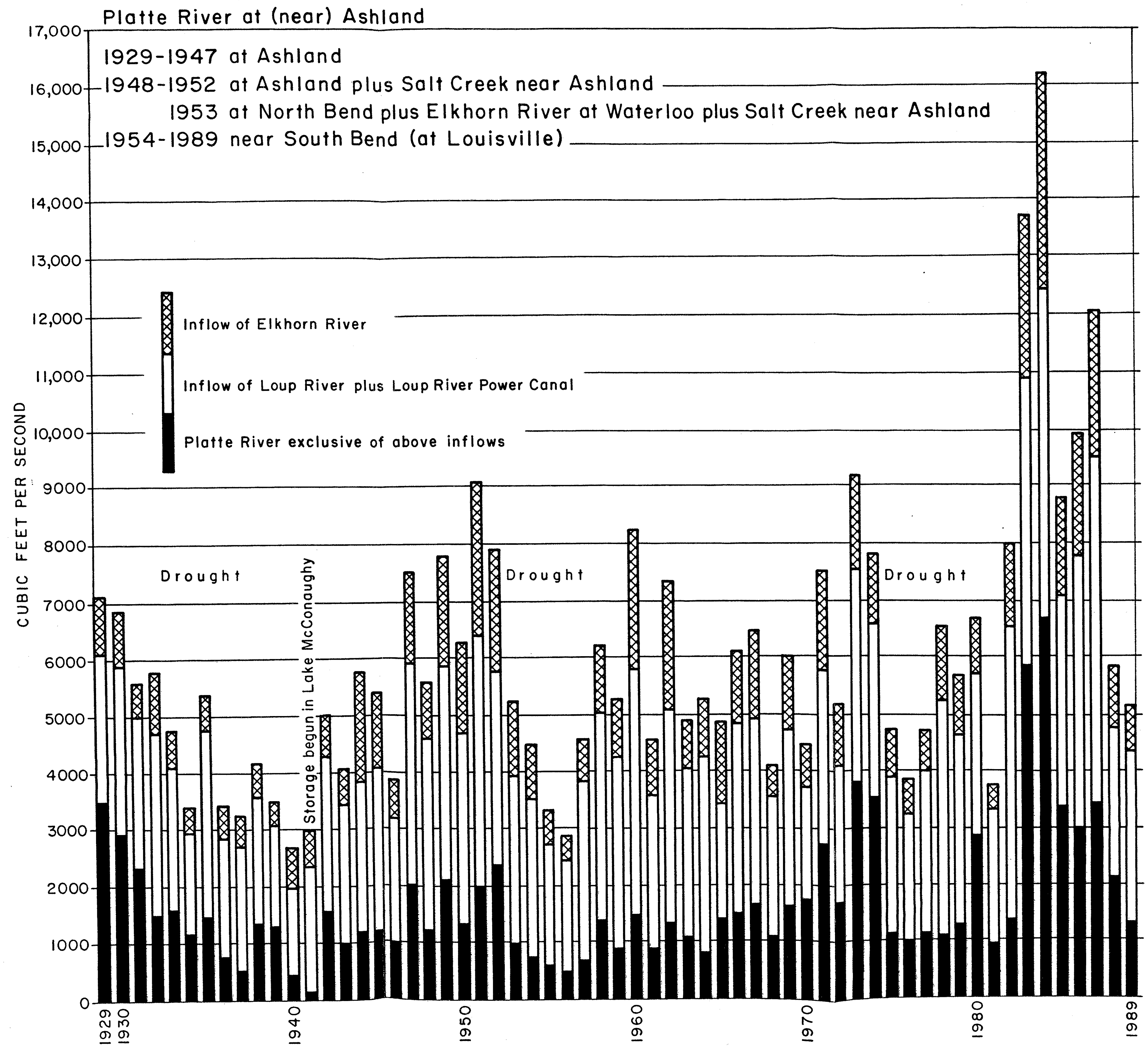
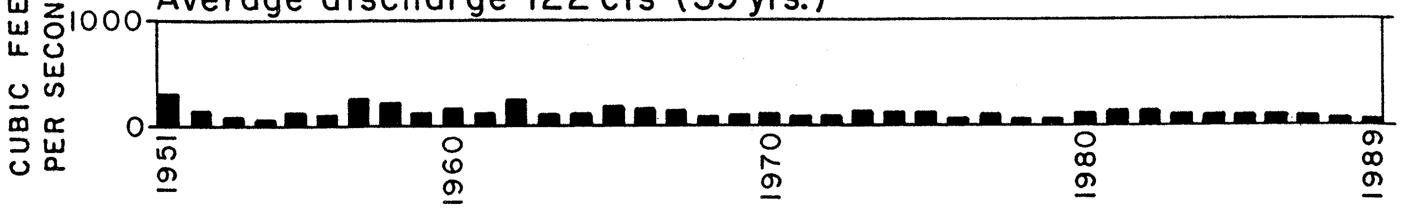


PLATE 15


Platte River at (near) Ashland
1929-1947 at Ashland
1948-1952 at Ashland plus Salt Creek near Ashland
1953 at North Bend plus Elkhorn River at Waterloo plus Salt Creek near Ashland
1954-1989 near South Bend (at Louisville)
Inflow of Elkhorn River
Inflow of Loup River plus Loup River Power Canal
Platte River exclusive of above inflows
CUBIC FEET PER SECOND
Drought
Storage begun in Lake McConaughy
Drought
Drought
17,000
16,000
15,000
14,000
13,000
12,000
11,000
10,000
9000
8000
7000
6000
5000
4000
3000
2000
1000
0
1929
1930
1940
1950
1960
1970
1980
1989

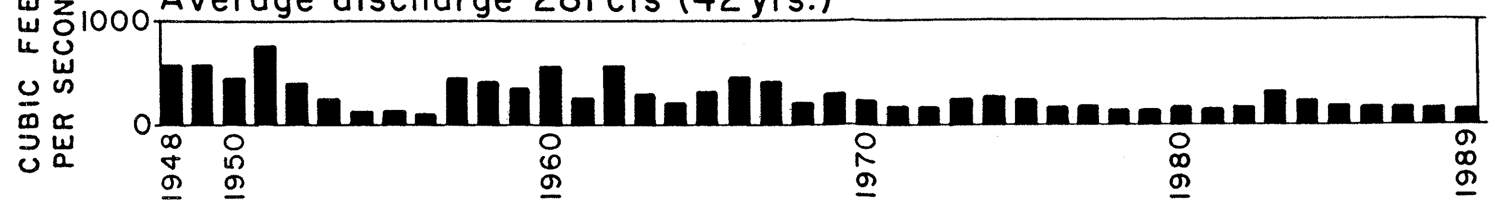
8285

Republican River at Stratton
Average discharge 122 cfs (39 yrs.)



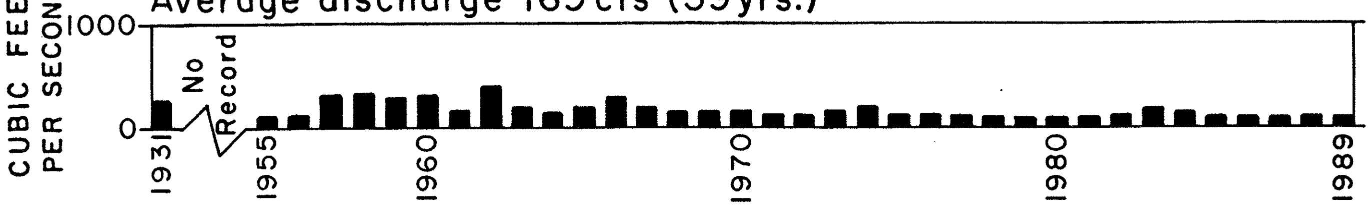
8475

Republican River near Orleans
Average discharge 281 cfs (42 yrs.)



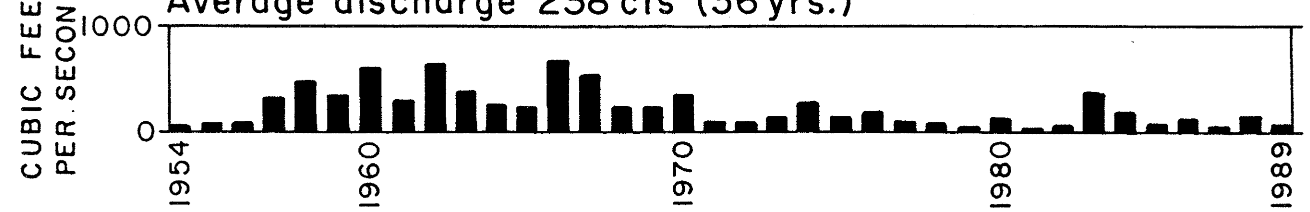
8370

Republican River at McCook
Average discharge 169 cfs (59 yrs.)



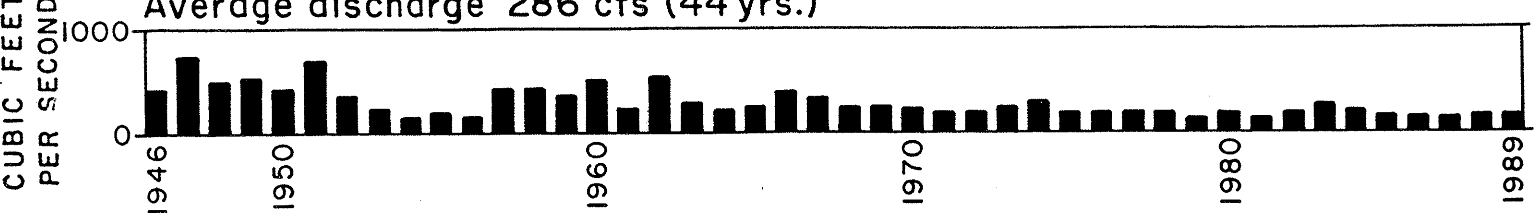
8495

Republican River below Harlan County Dam
Average discharge 238 cfs (36 yrs.)



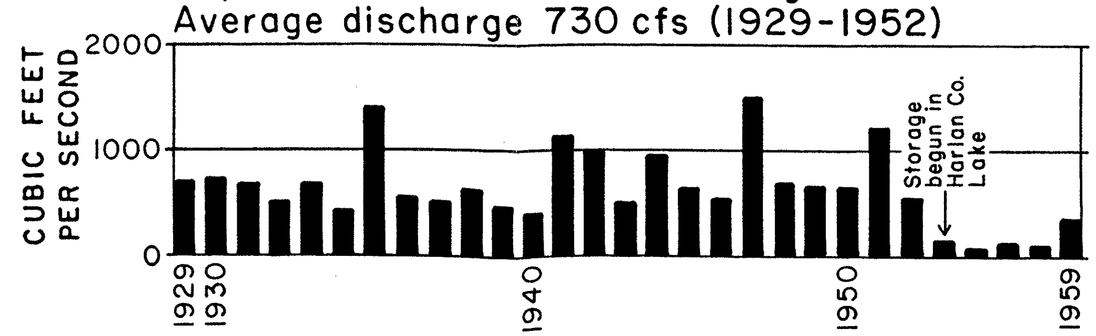
8435

Republican River at Cambridge
Average discharge 286 cfs (44 yrs.)



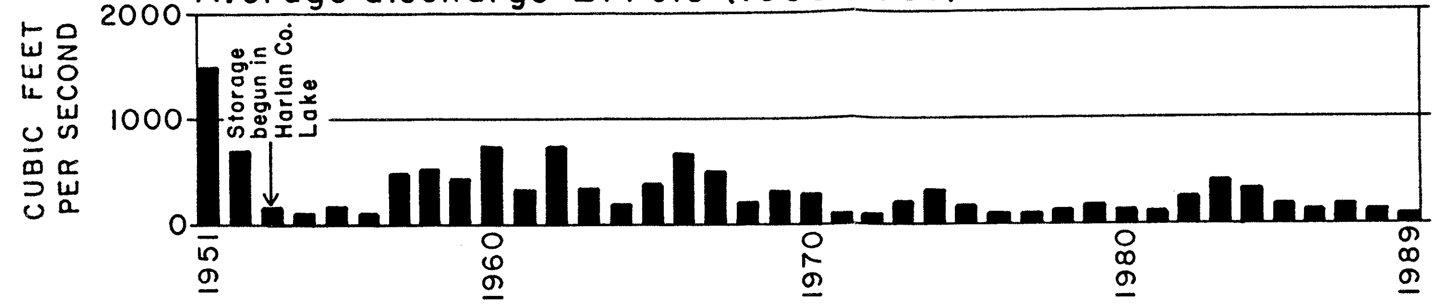
8505

Republican River near Bloomington
Average discharge 730 cfs (1929-1952)



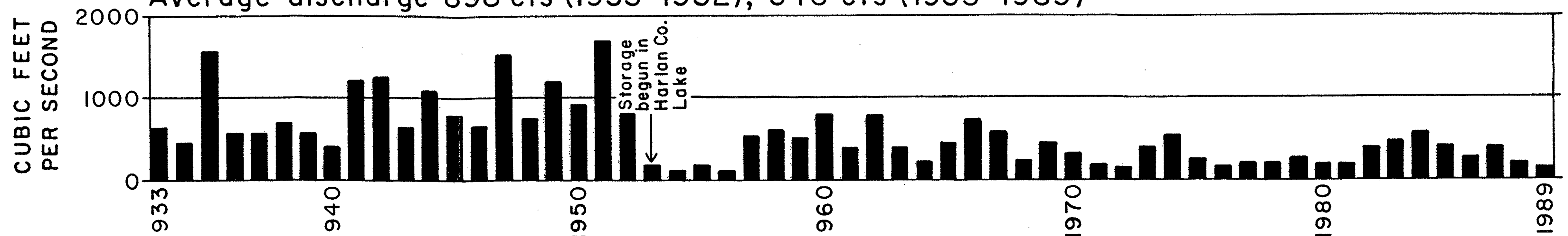
8530.2

Republican River at (near) Guide Rock
Average discharge 271 cfs (1953-1989)



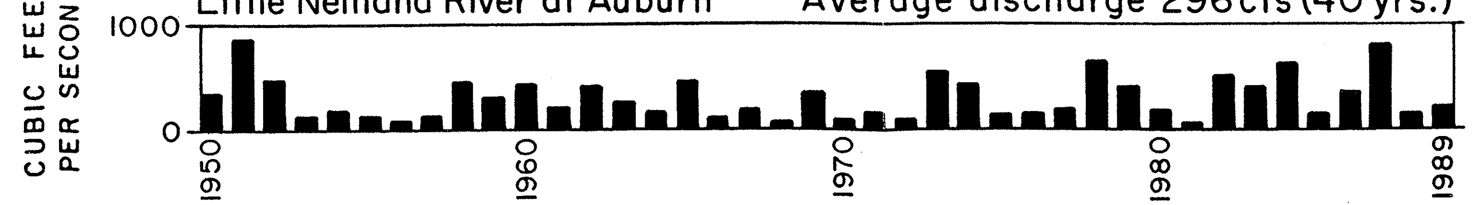
8535

Republican River near Hardy
Average discharge 898 cfs (1933-1952), 346 cfs (1953-1989)



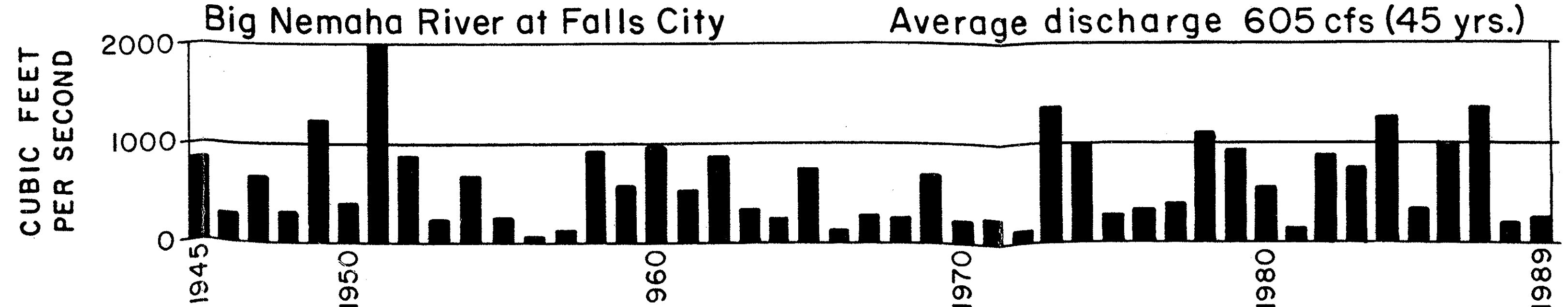
8115

Little Nemaha River at Auburn Average discharge 296 cfs (40 yrs.)



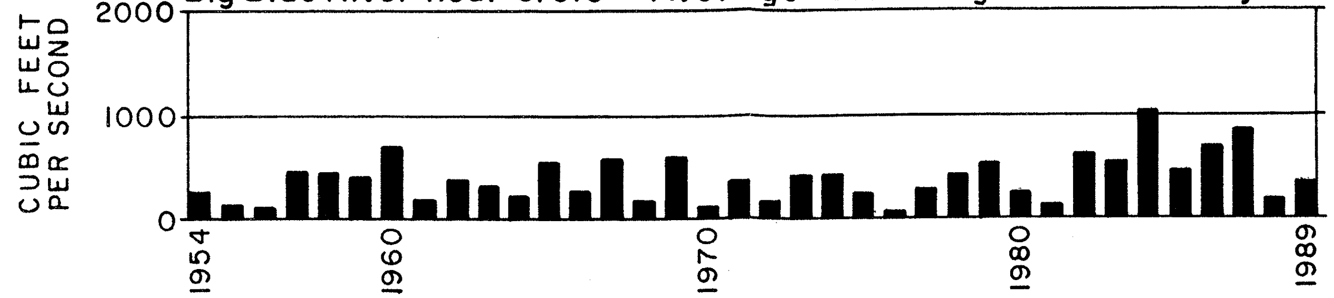
8150

Big Nemaha River at Falls City Average discharge 605 cfs (45 yrs.)



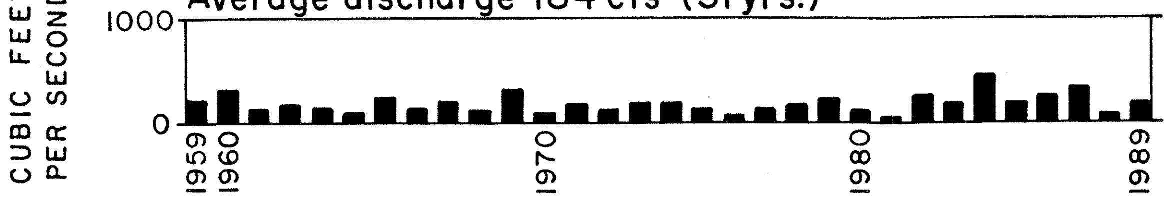
8810

Big Blue River near Crete Average discharge 397 cfs (36 yrs.)



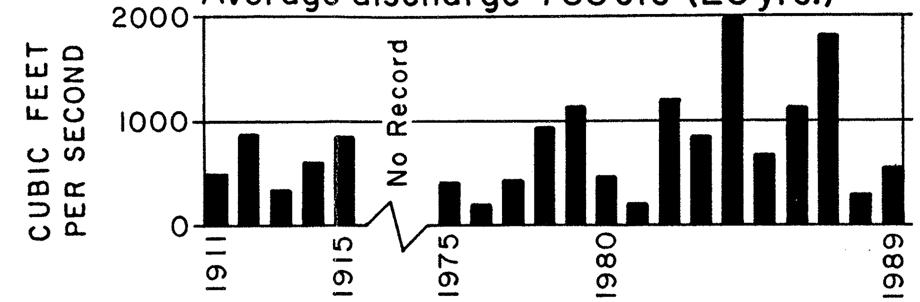
8808

West Fork Big Blue River near Dorchester
Average discharge 184 cfs (31 yrs.)



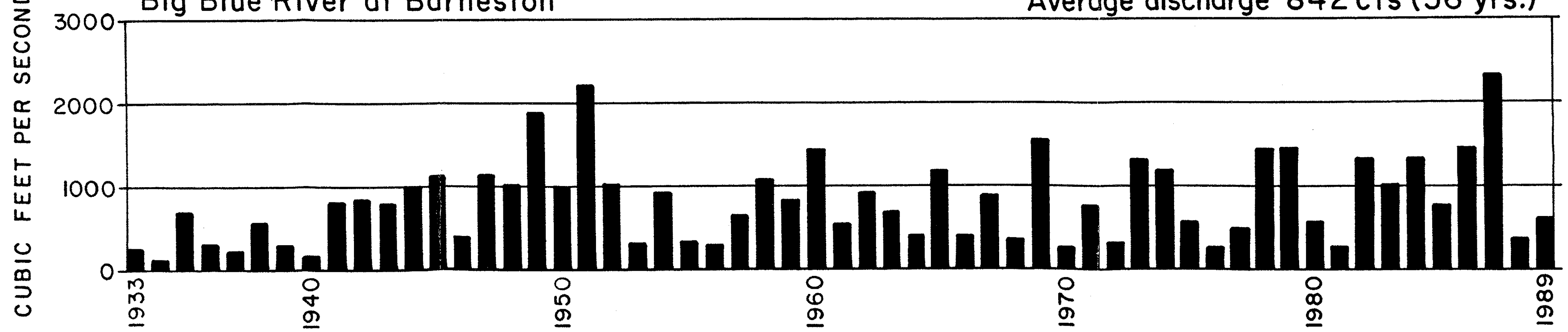
8815

Big Blue River at Beatrice
Average discharge 766 cfs (20 yrs.)



8820

Big Blue River at Barneston Average discharge 842 cfs (56 yrs.)



8840

Little Blue River near Fairbury Average discharge 381 cfs (68 yrs.)

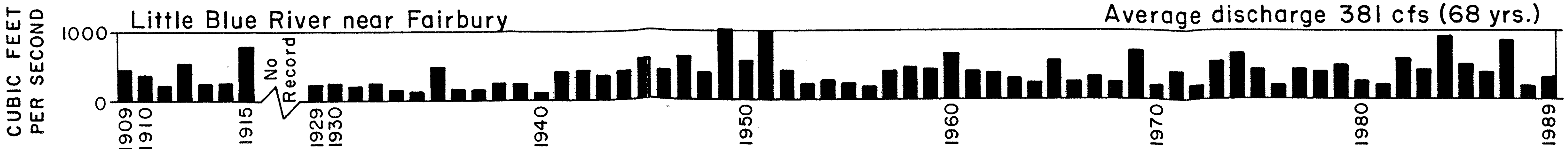
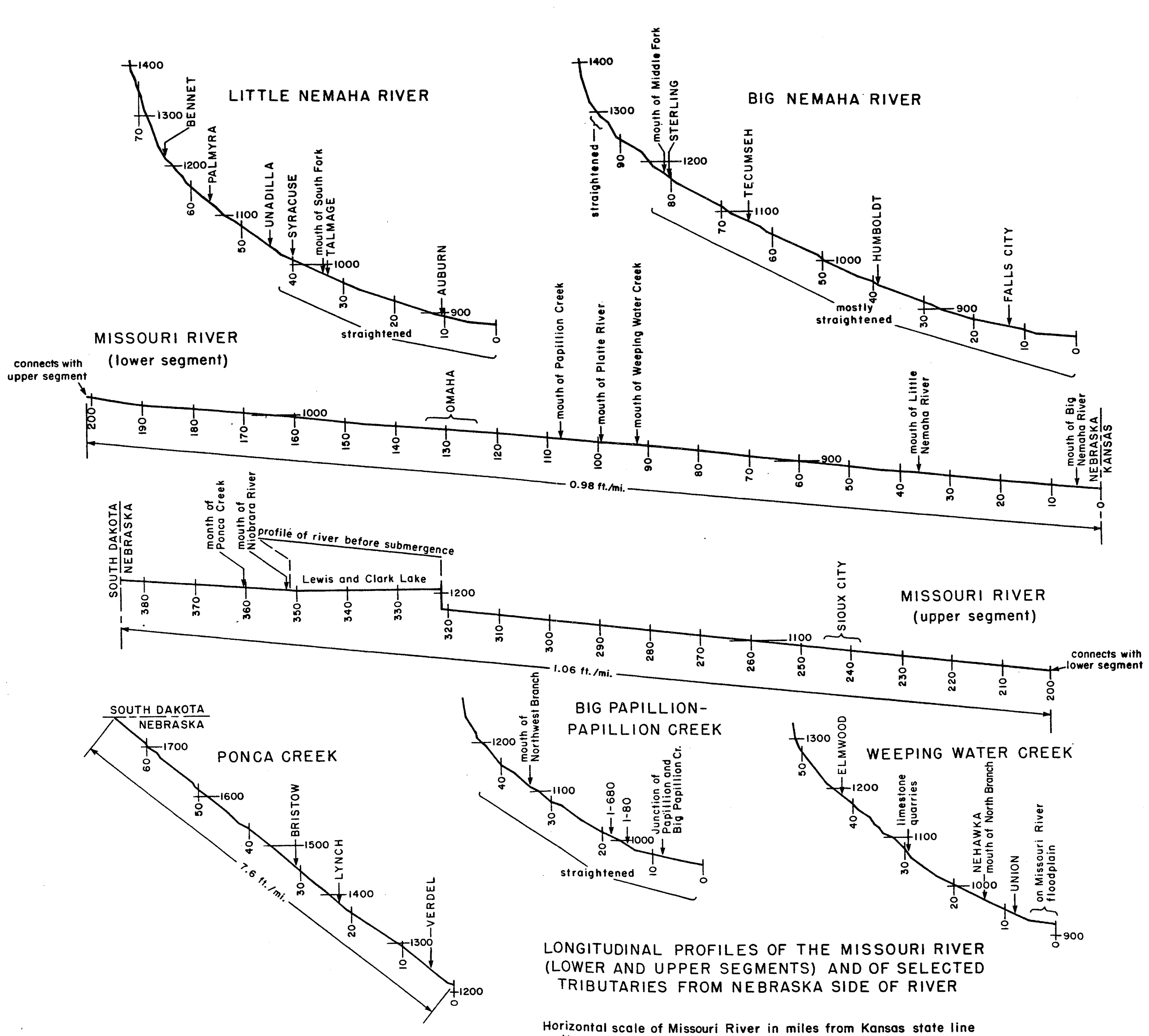


PLATE 19

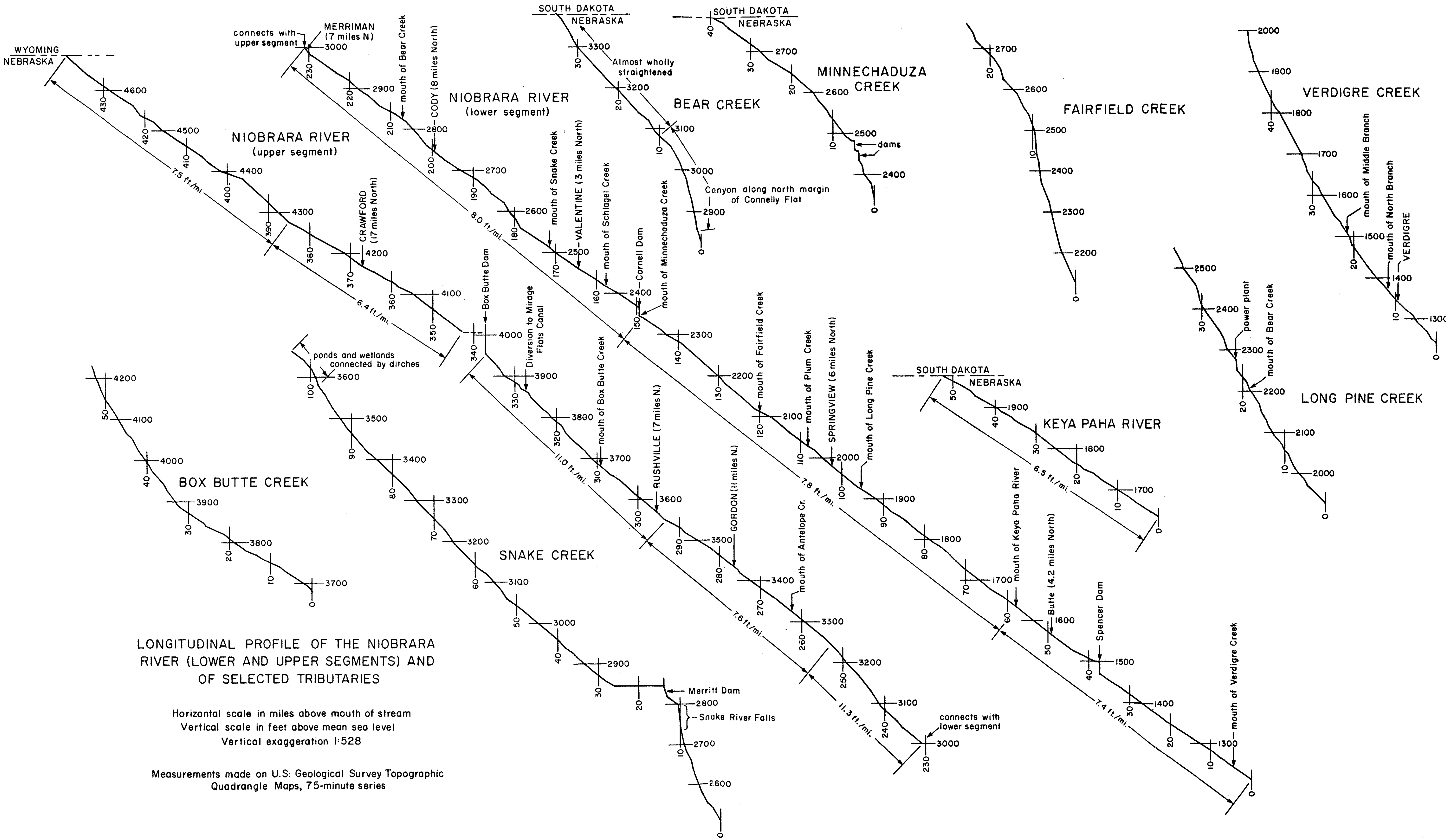


LONGITUDINAL PROFILES OF THE MISSOURI RIVER (LOWER AND UPPER SEGMENTS) AND OF SELECTED TRIBUTARIES FROM NEBRASKA SIDE OF RIVER

Horizontal scale of Missouri River in miles from Kansas state line
Horizontal scale of tributaries in miles above mouth of river
Vertical scale in feet above mean sea level
Vertical exaggeration 1:528

Measurements made on U.S. Geological Survey Topographic Quadrangle Maps, 7.5-minute series

PLATE 20

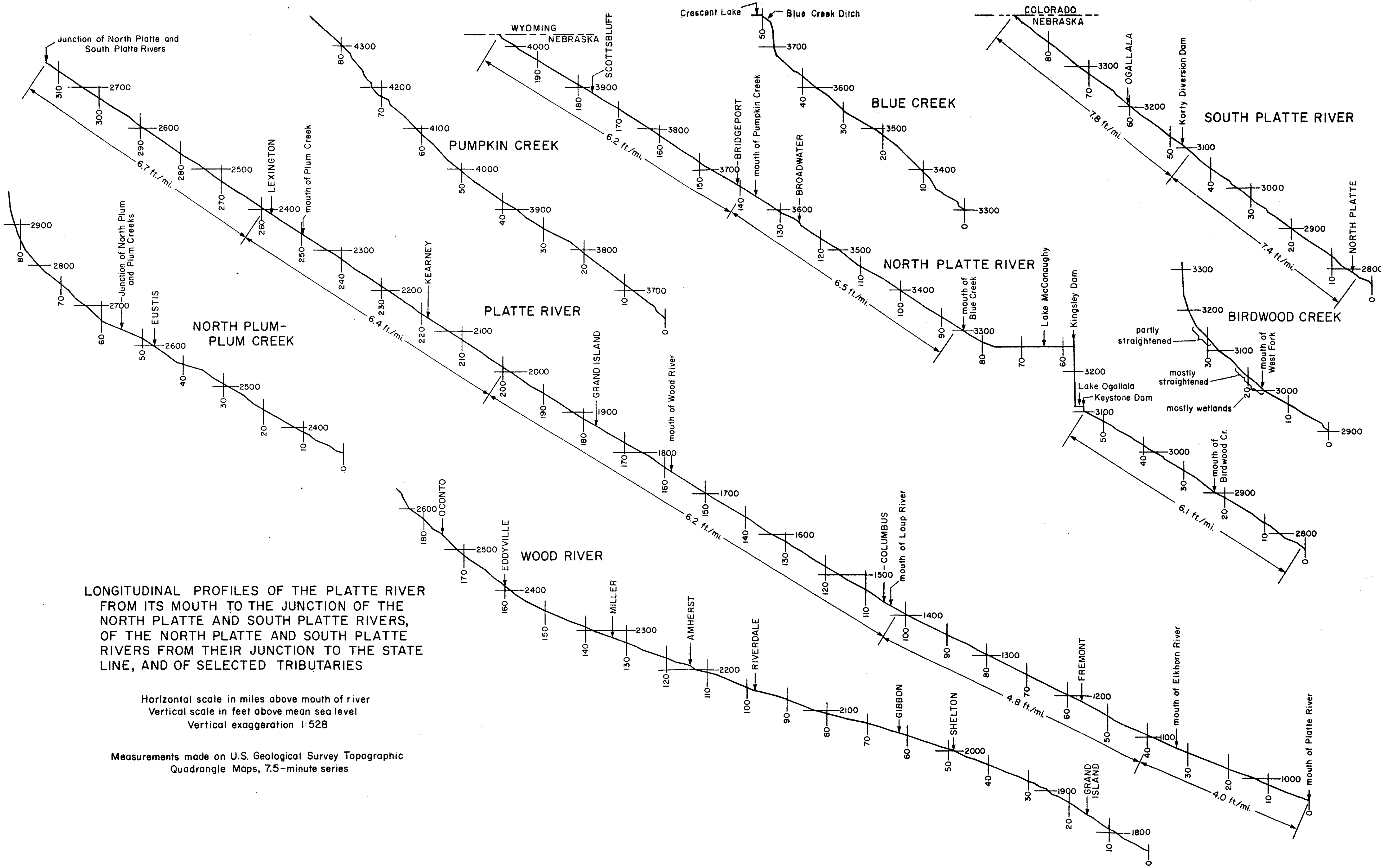


LONGITUDINAL PROFILE OF THE NIOBRARA RIVER (LOWER AND UPPER SEGMENTS) AND OF SELECTED TRIBUTARIES

Horizontal scale in miles above mouth of stream
Vertical scale in feet above mean sea level
Vertical exaggeration 1:528

Measurements made on U.S. Geological Survey Topographic Quadrangle Maps, 7.5-minute series

PLATE 21

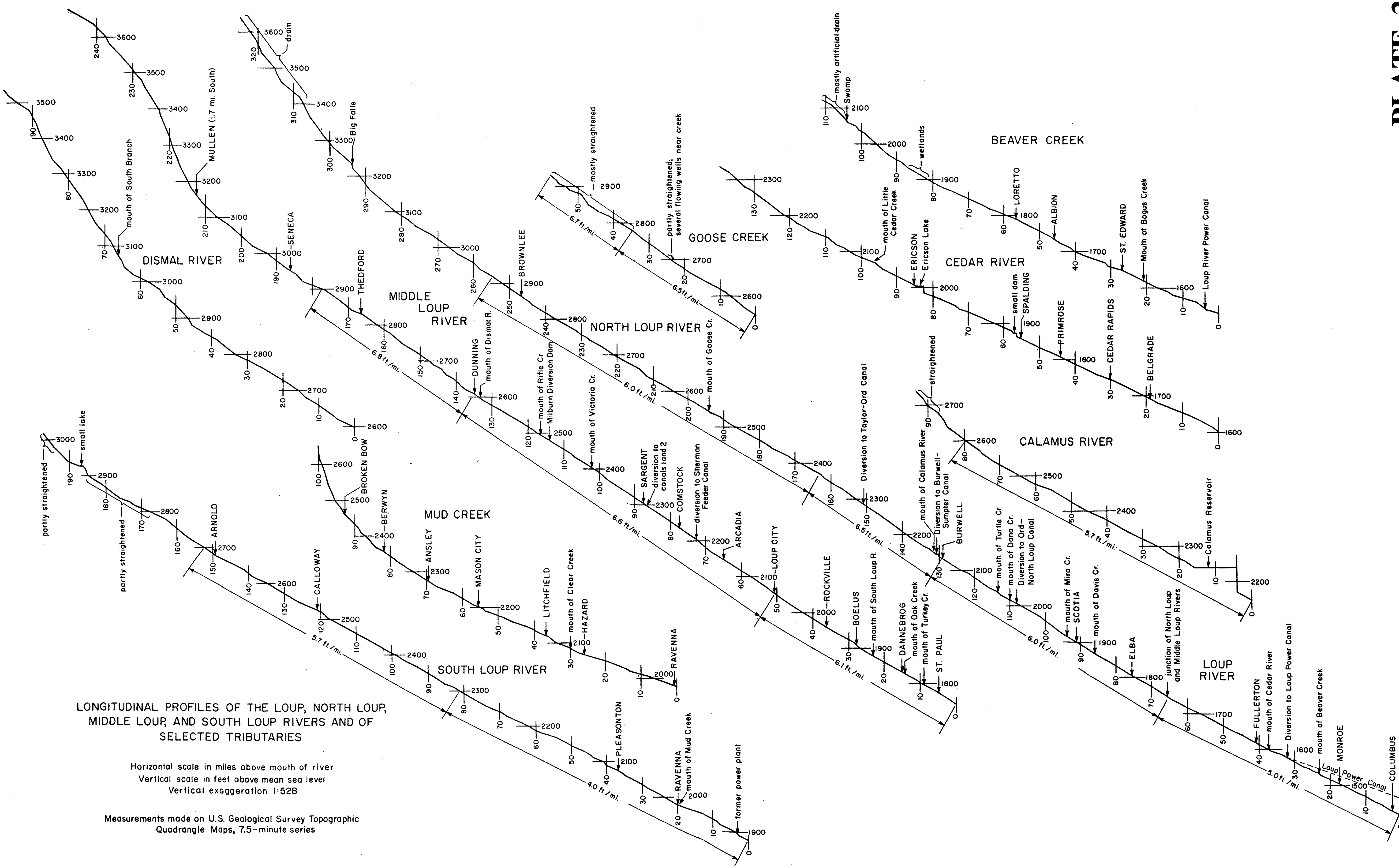


LONGITUDINAL PROFILES OF THE PLATTE RIVER FROM ITS MOUTH TO THE JUNCTION OF THE NORTH PLATTE AND SOUTH PLATTE RIVERS, OF THE NORTH PLATTE AND SOUTH PLATTE RIVERS FROM THEIR JUNCTION TO THE STATE LINE, AND OF SELECTED TRIBUTARIES

Horizontal scale in miles above mouth of river
Vertical scale in feet above mean sea level
Vertical exaggeration 1:528

Measurements made on U.S. Geological Survey Topographic Quadrangle Maps, 7.5-minute series

PLATE 22

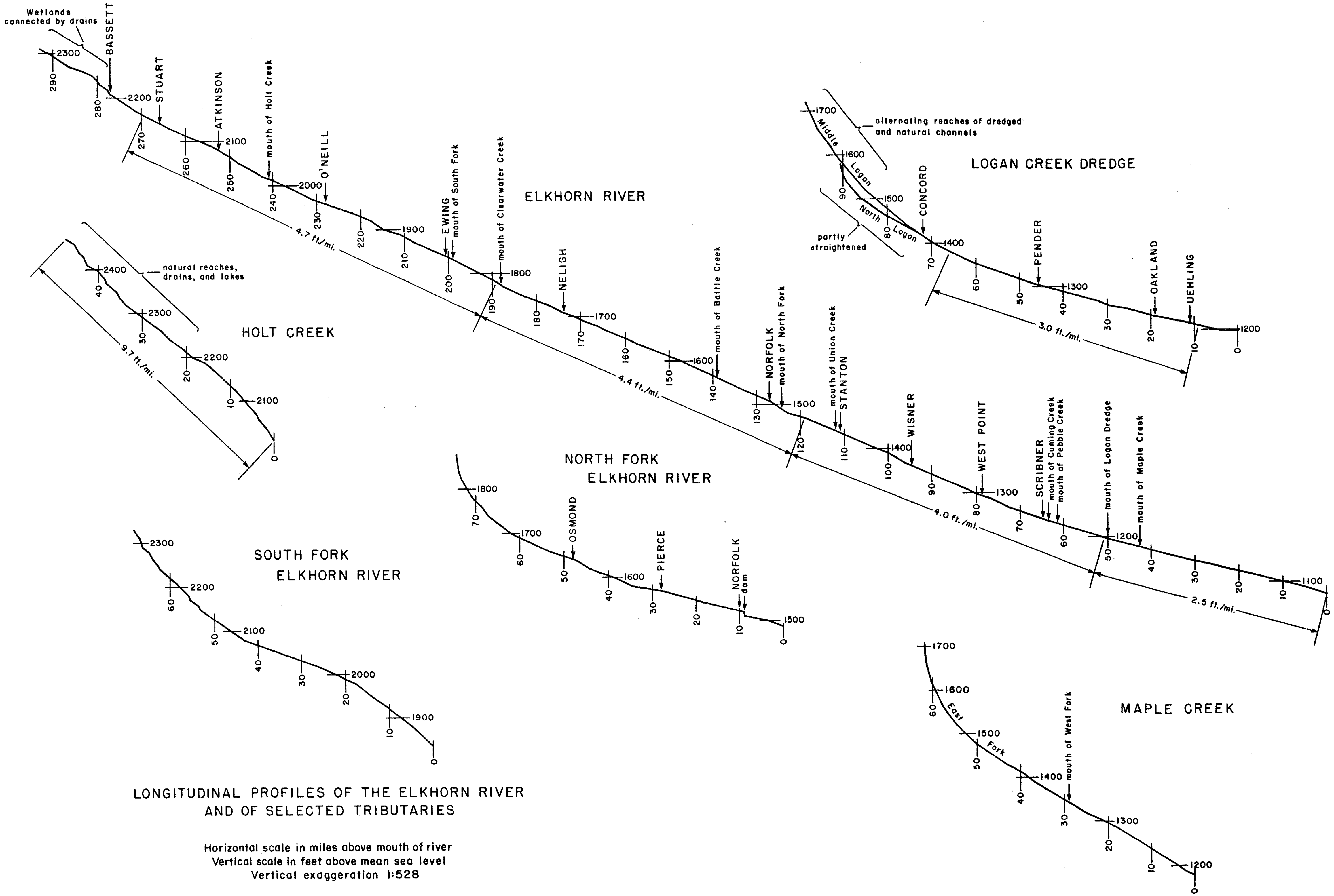


LONGITUDINAL PROFILES OF THE LOUP, NORTH LOUP, MIDDLE LOUP, AND SOUTH LOUP RIVERS AND OF SELECTED TRIBUTARIES

Horizontal scale in miles above mouth of river
Vertical scale in feet above mean sea level
Vertical exaggeration 1:528

Measurements made on U.S. Geological Survey Topographic Quadrangle Maps, 7.5-minute series

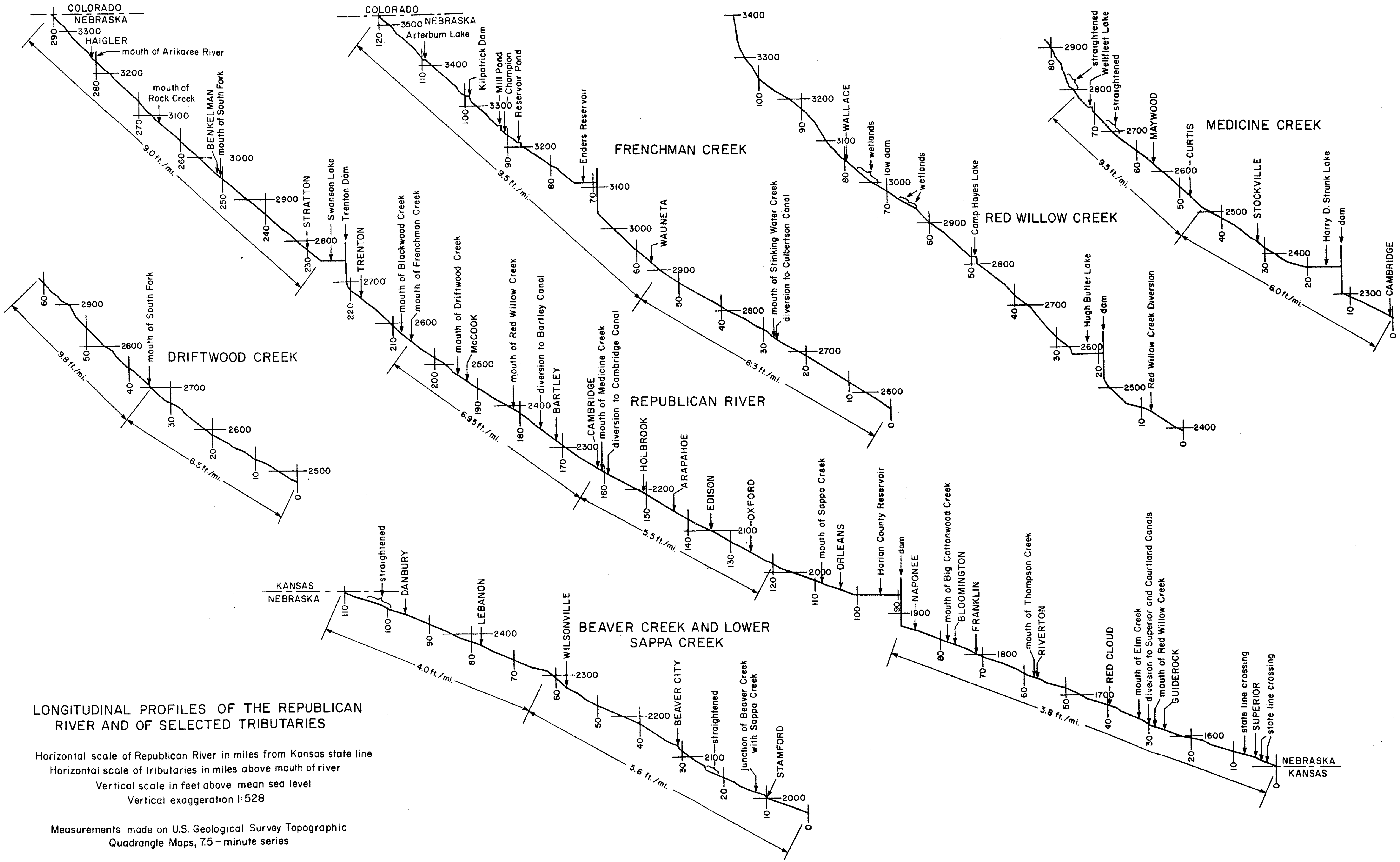
PLATE 23



LONGITUDINAL PROFILES OF THE ELKHORN RIVER
AND OF SELECTED TRIBUTARIES

Horizontal scale in miles above mouth of river
Vertical scale in feet above mean sea level
Vertical exaggeration 1:528

Measurements made on U.S. Geological Survey Topographic
Quadrangle Maps, 7.5-minute series

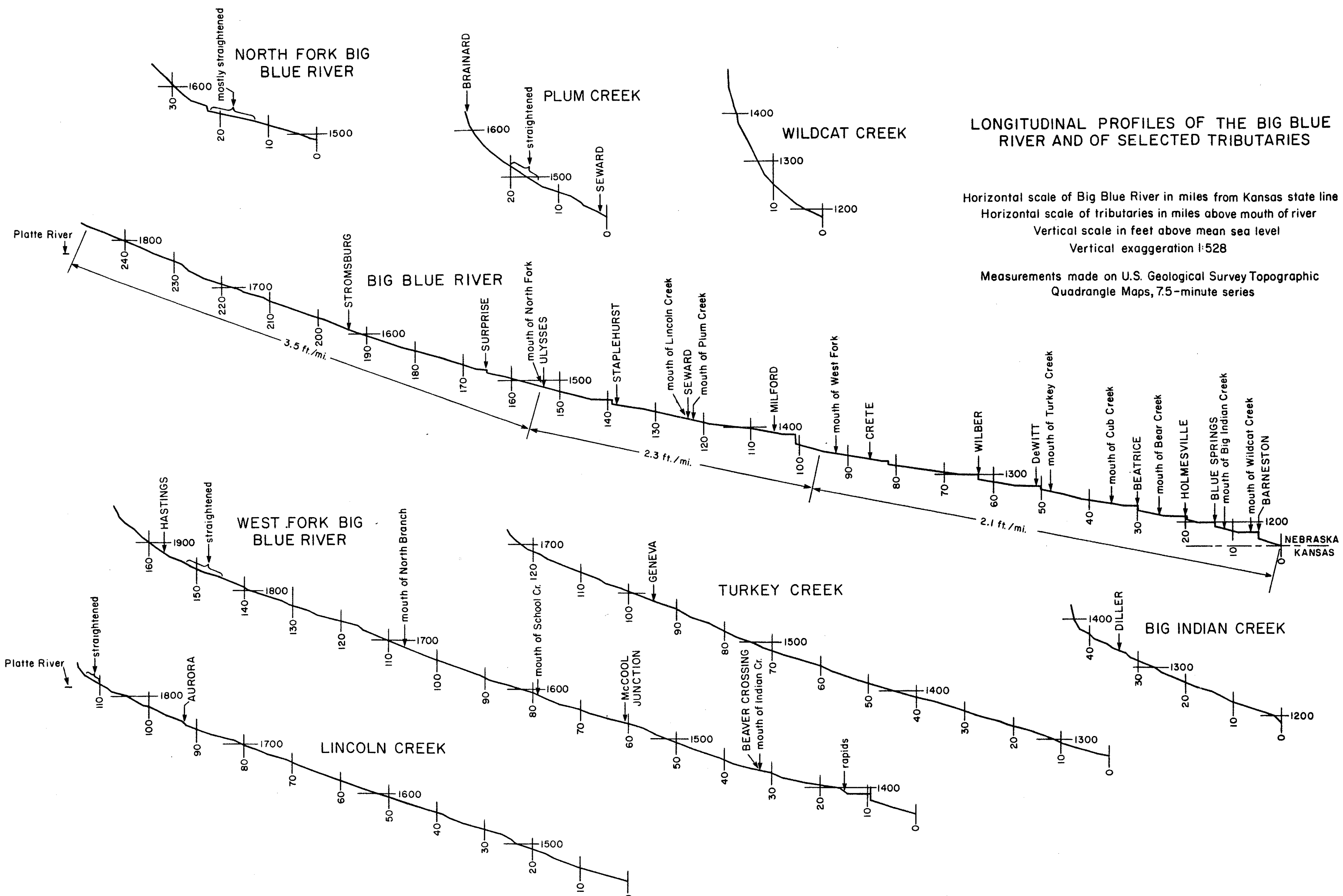


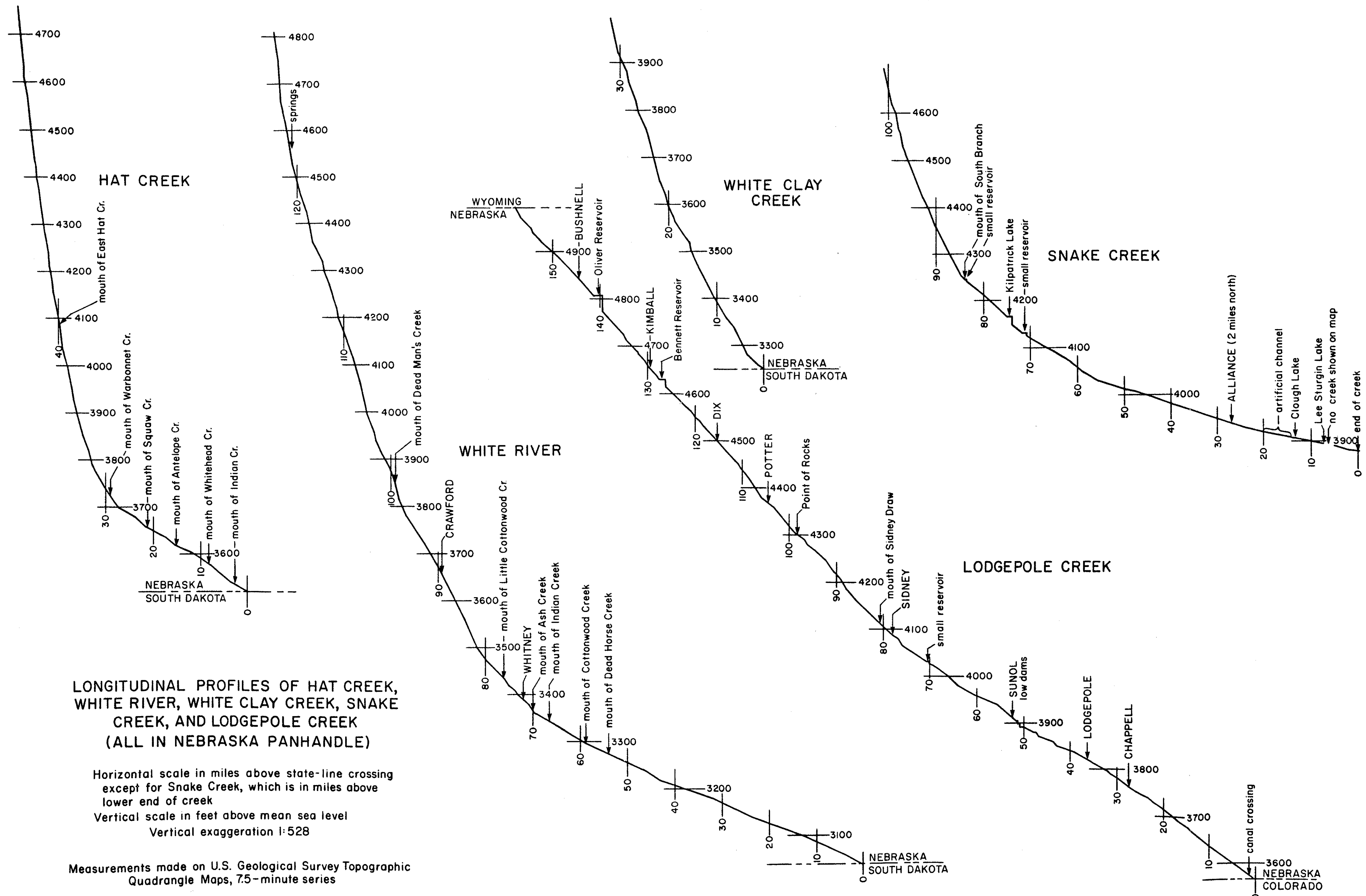
LONGITUDINAL PROFILES OF THE REPUBLICAN RIVER AND OF SELECTED TRIBUTARIES

Horizontal scale of Republican River in miles from Kansas state line
Horizontal scale of tributaries in miles above mouth of river
Vertical scale in feet above mean sea level
Vertical exaggeration 1:528

Measurements made on U.S. Geological Survey Topographic Quadrangle Maps, 7.5-minute series

PLATE 25


LONGITUDINAL PROFILES OF THE BIG BLUE RIVER AND OF SELECTED TRIBUTARIES
Horizontal scale of Big Blue River in miles from Kansas state line
Horizontal scale of tributaries in miles above mouth of river
Vertical scale in feet above mean sea level
Vertical exaggeration 1:528
Measurements made on U.S. Geological Survey Topographic Quadrangle Maps, 7.5-minute series
NORTH FORK BIG BLUE RIVER
mostly straightened
PLUM CREEK
BRAINARD
straightened
SEWARD
WILDCAT CREEK
BIG BLUE RIVER
Platte River
3.5 ft./mi.
2.3 ft./mi.
2.1 ft./mi.
STROMSBURG
SURPRISE
mouth of North Fork
ULYSSES
STAPLEHURST
mouth of Lincoln Creek
SEWARD
mouth of Plum Creek
MILFORD
mouth of West Fork
CRETE
WILBER
DeWITT
mouth of Turkey Creek
mouth of Cub Creek
BEATRICE
mouth of Bear Creek
HOLMESVILLE
BLUE SPRINGS
mouth of Big Indian Creek
mouth of Wildcat Creek
BARNESTON
NEBRASKA
KANSAS
WEST FORK BIG BLUE RIVER
HASTINGS
straightened
mouth of North Branch
mouth of School Cr.
McCOOL JUNCTION
BEAVER CROSSING
mouth of Indian Cr.
rapids
TURKEY CREEK
GENEVA
BIG INDIAN CREEK
DILLER
LINCOLN CREEK
Platte River
straightened
AURORA



LONGITUDINAL PROFILES OF HAT CREEK, WHITE RIVER, WHITE CLAY CREEK, SNAKE CREEK, AND LODGEPOLE CREEK (ALL IN NEBRASKA PANHANDLE)

Horizontal scale in miles above state-line crossing except for Snake Creek, which is in miles above lower end of creek
Vertical scale in feet above mean sea level
Vertical exaggeration 1:528

Measurements made on U.S. Geological Survey Topographic Quadrangle Maps, 7.5-minute series